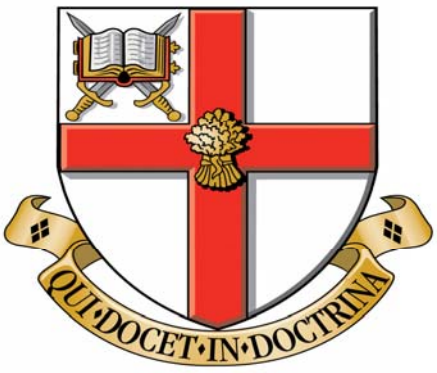

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SIX SIGMA AS A FACET OF CHANGE MANAGEMENT AT PCN PHARMACEUTICALS

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CHESTER BUSINESS SCHOOL

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Abstract

This study looks at the six sigma training program that has been introduced within PCN Pharmaceuticals as a facet of change management. It examines the perceptions of a sample group on the subject of both a six sigma program and the management of change through the use of a questionnaire. This methodology is utilised in order to understand the perceptions around the implementation of the six sigma program after the initial roll-out.

The research concludes that PCN needs to gain an understanding as to why a number of six sigma projects have not yet been completed despite attendance at six sigma training by site employees. The research findings reveal that there is not enough communication and support around the six sigma program, especially from the PCN management team. This communication also needs to reinforce the concept of change being central to the six sigma process. The research finds that the drivers for change within PCN are understood, along with the strategic goals and objectives. Furthermore, the research finds that an effective infrastructure needs to be put in place at PCN to support the six sigma program in order that it may be successful.

Declaration

This work is original and has not been submitted previously for any academic purpose. All secondary sources are acknowledged.

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1 Introduction

1.1 Background to the Research

Most organisations, as well as most people, face changes at some point in their life. Hayes (2007) suggests that these changes can be large or small, evolutionary or revolutionary, sought after or resisted. Pardey (2007) asserts that change is inevitable as new technologies, new social structures and new trading mechanisms transform the workplace. The change management process will be reviewed to compare and contrast the contemporary thinking in order to understand the drivers for change and the management of this change within PCN Pharmaceuticals (PCN).

The organisation that is the subject of the research is PCN Pharmaceuticals, specifically one of the manufacturing facilities based within the United Kingdom. The organisation is part of a global organisation that has developed over a number of years as a result of a number of mergers and acquisitions within the pharmaceutical industry. The journal article Partnering for survival in pharmaceuticals (2007) states that the pharmaceutical industry is one of the supposed lucky ones: the demand for medicines and drugs can and will only go up. The article highlights, that despite this, there are a number of issues which are affecting the pharmaceutical industry such as the need to constantly refresh the pipeline with new and better medicines whilst at the same time generic product competitors are applying the pressure. It is these drivers, amongst others, that emphasise the need for change and PCN recognises that it needs to do things differently, in addition to doing different things, and that change needs to be as a result of continuous improvement and should be planned rather than reactive.

PCN has recently introduced a programme to train its staff in the implementation of the methodology of six sigma as part of the change management process. Kumar, Antony, Madu, Montgomery and Park (2008) found that with more than two decades of successful implementation of six sigma methodologies at major corporations, the success and benefits possible with six sigma are well documented. Blokdijk (2008) describes six sigma as a set of disciplined methodologies that are being used to eliminate defects in any given process and that it is often seen as the ultimate aim to achieve high quality products and services. Bendell (2006) asserts that six sigma is typically a strategic, company wide approach, that focuses on variation reduction and

that these projects have the potential to simultaneously reduce costs and increase customer satisfaction and it is this potential cost reduction that is just one of the drivers for introducing the six sigma methodology to PCN.

1.2 Research Question

The research topic will examine the change management process within PCN along with both the internal and external drivers for change. The research will review the six sigma methodology that has recently been introduced at PCN and how this methodology influences the process of change within PCN and the pharmaceutical industry.

The research question is as follows:

Six sigma as a facet of change management at PCN Pharmaceuticals.

The aims of the research are as follows:

- To understand contemporary thinking on six sigma.
- To understand contemporary thinking on change management.
- To investigate the current approach to six sigma at PCN.
- To investigate the current approach to change management at PCN.
- To compare and contrast the contemporary thinking with the current approaches at PCN.
- To draw conclusions and make recommendations for the implementation of the six sigma process as a facet of the PCN change management programme.

1.3 Justification for the Research

The research is justified from a theoretical perspective as the role of six sigma has been the subject of recent academic research in addition to being the subject of many business books and training courses. Blokdijk (2008) states that it is known worldwide as the best quality management system that the business environment has encountered and this, therefore, gives a good reason for the subject to be examined further. Six sigma can be compared to other process improvement methodologies such as Total Quality Management (TQM) and Lean thinking which have also been the subject of research within the last two decades in conjunction with comparisons of these

methodologies. Bendell (2006) refers to both six sigma and lean as two current hot process improvement approaches. As a result the research will compare these methodologies and examine some of the differences along with the similarities between them. The history and the development of process improvement methodologies, along with their influence on organisations, will be examined in order to understand the impact on an organisation that utilises these tools and techniques.

PCN is a multinational pharmaceutical company which has manufacturing facilities throughout the United Kingdom (UK), Europe and the United States of America (USA). The PCN operations are split into a number of business divisions where each division focuses on a different segment of the pharmaceutical market. The division of PCN where the researcher is employed has recently introduced a company tailored version of six sigma training as part of an organisational initiative to introduce a process improvement programme throughout the global organisation. The programme is an initiative that has been rolled out throughout the organisation during the last eighteen months and, to date, personnel have been trained in the same programme at manufacturing facilities in the UK, USA and Europe.

The pharmaceutical industry is a highly regulated business where the details of a product's manufacturing process are typically registered with the health authorities who approve the products which are sold within their jurisdiction. As a result any changes to the parts of the processes that are detailed within these registrations require prior approval from the appropriate authorities. Depending on the significance of these changes the regulatory authorities require annual notification of simple changes or may require other notification for more complex changes which may take from thirty days up to a number of years before they approve the implementation of the change. Consequently organisations within the pharmaceutical industry may be reluctant to change due to the time and effort involved to implement a change.

The academic research into the area of change and the management of the change process will be addressed reflecting on the available process improvement models. The paradigms of change will be considered along with the process models of change. The research will review the reasons for change whilst contemplating the environment of the pharmaceutical industry and the culture of the PCN organisation as potential drivers or reasons for resistance to change. The current approach to six sigma at PCN, and how

these tools are utilised as part of the change management process, will be evaluated along with the role of change agents. The leadership of the change agents will be considered in relation to the six sigma projects they lead as part of the change management implementation process within PCN.

1.4 Methodology

The philosophy that has been selected for this research is a phenomenological approach, also known as interpretivism. The justification for selecting this approach is due to the axiology and experience of the researcher. Saunders, Lewis and Thornhill (2009) comment that the axiology of an interpretivism research philosophy is one where the researcher is part of what is being researched, cannot be separated and so will be subjective. The approach to the research will be combined and will initially be using deductive theory. The research approach will then make use of induction to build the theory as this approach emphasises the human factor, and therefore the perceptions of those within the organisation, to both the change management process and the six sigma process.

In order to answer the research question the research strategy chosen will consist of semi-structured interviews and a questionnaire. The sample size will be chosen so as to be representative of those directly involved with six sigma and change. Semi-structured interviews will be conducted by utilising a small sample group in order to assist in the design of the questionnaire. A questionnaire will then be piloted with a small group and any modifications will be completed prior to its distribution to a wider audience. This will ensure that the questionnaire is a reliable instrument to aid the research. The anonymity of the respondents will be kept throughout the research.

1.5 Outline of the Chapters

Chapter 1: The research problem and the background to the research are introduced within the first chapter. The research question and the aims of the research are also introduced.

Chapter 2: Chapter two will provide a detailed review of the relevant literature including the literature on six sigma, process improvement and change. The factors

influencing change such as the environment, culture and leadership will also be discussed.

Chapter 3: The third chapter outlines the methodology utilised for the research. The research strategy chosen and the justification for its use are described along with the details behind the design of the research.

Chapter 4: Chapter four presents the findings of the research and the results from the methodologies applied to the research.

Chapter 5: The fifth chapter analyses the findings and results from chapter four. This chapter draws conclusions from the research and details opportunities for future research.

1.6 Definitions

PCN Pharmaceuticals (PCN): The researcher's organisation is a global pharmaceutical company and will be referred to as PCN Pharmaceuticals (PCN) to ensure the anonymity of the organisation throughout the research.

Pharmaceutical industry: The term pharmaceutical industry, as defined within this research, refers to the research, development, manufacture, marketing and sale of pharmaceutical products. The scope of the term pharmaceutical products incorporates prescription medicines, over the counter drugs, generic drugs and vaccines.

Six sigma: Six sigma is defined as an approach to improvement and quality management that originated in the Motorola company but which was widely popularised by its adoption in the GE Company in America (Slack, Chambers & Johnston, 2007, p. 705). Slack et al. further define it as a broader philosophy of improvement that recommends a particular approach to measuring, improving and managing quality and operations performance. The name six sigma is also used within this research to define the company tailored training programme and improvement process utilised by PCN.

Lean: The term lean utilised within the research encompasses the methodologies referred to within the literature as lean, lean production, lean manufacturing or lean thinking.

Process: A process or processes are defined as a set of input resources which are used to transform something, or are transformed themselves, into outputs of products and services (Slack et al., 2007, p. 8).

Culture: Culture as it relates to an organisation is defined by Burnes (2004, p.169) as the particular set of values, beliefs, customs and systems that are unique to that organisation.

PESTLE analysis: Political, Economic, Socio-cultural, Technological, Legal, Environmental.

SWOT analysis: Strengths, Weaknesses, Opportunities, Threats.

1.7 Summary

Chapter one introduces the background and justification to the research. The research problem and the research question are detailed along with the aims of the research. The methodology to be used for the research is briefly described along with the justification for its use. The outline of the research and the details of the subsequent chapters are described. On these foundations as described within chapter one the dissertation can proceed with a detailed description of the research contained within the following chapters.

2 Literature Review

2.1 Introduction

The research examines the literature relating to six sigma along with lean and other available process improvement methodologies. The literature on change management will be reviewed including the paradigms of change, the reasons for change and resistance to change. The research will include journals such as *The TQM Magazine* and *Harvard Business Review*. Key texts for this literature review will include Blokdijk (2008); Womack and Jones (2003); Hayes (2007); Burnes (2004); Gilgeous (1997).

2.2 Six Sigma

Six sigma has been used by many businesses in recent years as a process and quality improvement tool. Blokdijk (2008) credits Motorola as the founder of this six sigma methodology and also states that they are living evidence of its wonders. Rather than being thought of as a methodology Antony (2007) asserts that six sigma is a powerful management strategy that has evolved from being exclusively about the original target of less than four failures per million opportunities. Although six sigma can be thought of solely as about reducing the failure rate Siha and Saad (2008) argue that the six sigma program is much more than that.

Blokdijk (2008) asserts that over two decades, six sigma has been used as a form of business strategy. Six sigma has evolved from this focus on defect reduction to a focus on cost reduction and more recently to a third generation with a focus on creating value to customers (Antony, 2007). The evolution has taken place over the last few years and Kumar, Antony, Madu, Montgomery and Park (2008) found that with more than two decades of successful implementation of six sigma methodologies at major corporations, the success and benefits possible with six sigma are well documented. Dahlgaard and Dahlgaard-Park (2006) state that from 1990 the six sigma process was adapted to the non-manufacturing areas of Motorola after it was initially developed and implemented within their manufacturing departments. The six sigma methodology has been utilised in both the public and private sector and has been used in all aspects of organisations not just manufacturing processes.

In trying to define six sigma Blokdijk (2008) describes it as a set of disciplined methodologies that are being used to eliminate defects in any given process and that it is often seen as the ultimate aim to achieve high quality products and services. Klefsjö, Wiklund and Edgeman (2001) state that six sigma provides a structured means of pushing product and process improvement, but they do not see it is an alternative to TQM (Total Quality Management). These product and process improvements can be managed as individual projects to manage the change process. Bendell (2006) asserts that six sigma is typically a strategic, company wide approach that focuses on variation reduction and that these projects have the potential to simultaneously reduce costs and increase customer satisfaction. Klefsjö et al. (2001) note that six sigma's focus on processes and variation is central to what is historically thought of as quality control. It is this focus on the quality of the products and services offered by organisations that Antony (2007) argues focuses on increasing the wealth of the shareholders by improving bottom-line results.

2.2.1 Tools and Training

Six sigma utilises the DMAIC (Define, Measure, Analyse, Improve, Control) model as a road map to guide those using six sigma through the activities and tools that can be used to characterise and optimise the processes within an organisation. Blokdijk (2008) asserts that these five key elements … are essential steps to ensure the success of development and improvement projects. Kumar et al. (2008) assert that the six sigma methodology DMAIC links the tools and techniques in a sequential manner which is not emphasised in TQM. The DMAIC methodology is similar to the Deming Cycle which guides us toward improvement (Neave, 1990), commonly known as the PDCA (Plan, Do, Check, Act) Cycle.

The six sigma training makes use of an array of statistical tools and techniques to support the DMAIC model and Bendell (2006) argues that six sigma may be criticised for a potential tendency towards complexity of technique and analysis. Carreira and Trudell (2006) assert that one of the benefits of using six sigma is that it is a data driven improvement process and it is these statistical tools that help to generate the data. Klefsjö et al. (2001) argue that what is new in six sigma is that efficient, often statistical, techniques are used in a systematic way to reduce variation and improve processes. A common perception is that six sigma focuses only on training in various

statistical tools and techniques and almost ignores the human factor, such as the culture of the company (Dahlgaard & Dahlgaard-Park, 2006; Kumar et al., 2008). Although this is not the case in every organisation as Antony (2007) asserts that six sigma has been very successful in integrating the human and process aspects of improvement.

Buch and Tolentino (2006) state that it is clear that training and reward systems are integral components of a successful six sigma program, and the two must be linked so that the learning and new responsibilities that follow are perceived by employees as rewards of the program. Six sigma training is usually to black or green belt level depending on whether the individual will be involved full or part-time with business improvements. In order for an individual to become a certified black or green belt they must complete a six sigma project utilising the tools learnt and have this signed off, an approach that Bendell (2006) argues ensures that the transfer of method to first application is effectively implemented. Carreira and Trudell (2006) state that having a black belt is not absolutely necessary, but having someone with certain skills is, but Antony (2007) argues that a characteristic of six sigma is that it creates a powerful team infrastructure for implementation of projects. Buch and Tolentino (2006) assert that involvement in a six sigma project team can be a source of social rewards by providing increased opportunities for employees to interact with co-workers … to work together toward shared goals and outcomes.

This indicates that six sigma is about more than just being trained in the methodology and it is Knippen and Green (1997) who claim that workers who are part of a problem's solution will work hard to make sure that their solution is successful. Kumar et al. (2008) assert that six sigma is more about changing the mindset of people, making a shift from a traditional approach of problem solving to a proactive approach. This change in mindset may not be a quick process and Blokdijk (2008) states that the six sigma way requires perseverance and patience for it to work out. Womack and Jones (2003) assert that the improvement team should be able to see things changing before their eyes – momentum for change within your organisation. This implies that those who been trained in the six sigma process need to have some quick win projects that show improvement within a short space of time.

2.2.2 Six Sigma and Lean

The six sigma initiative, as asserted by Kumar et al. (2008), is not the panacea that some insist. Another perspective is that there is nothing fundamentally new in six sigma (Bendell, 2006; Klefsjö et al., 2001). Dahlgaard and Dahlgaard-Park (2006) state that the lean production philosophy and the six sigma steps are essentially the same whilst Bendell (2006) argues that the two are related, but distinct. Whereas Blokdijk (2008) argues that the two methodologies when combined can perfectly complement each other. This is reinforced by Kumar et al. (2008) who state that six sigma employs some of the same tried and true tools and techniques of TQM. Additionally Dahlgaard and Dahlgaard-Park (2006) state that both lean production and six sigma quality comprise management and manufacturing philosophies and concepts, which have the same origin as the management philosophy, TQM. Therefore when considering six sigma one should also consider the related philosophies, such as TQM, that are captured under the lean umbrella.

Although the process improvement concepts were developed within manufacturing organisations they are equally applicable to any industry including the public sector and service industries. The philosophy of TQM as argued by Dahlgaard and Dahlgaard-Park (2006) is that it also used for all other processes in a company and all types of industries including services of any kind. Kumar et al. (2008) argue that the most common reason that service-orientated organisations stay away from six sigma is that they see it as a manufacturing solution. Despite this perception of a manufacturing bias the six sigma tools and techniques can be used throughout all parts of an organisation and it is the use of these tools to focus on the quality of service and customer satisfaction that has proved popular. As a result the use of six sigma has grown exponentially in the last couple of years in the European service industry (Kumar et al., 2008). Blokdijk (2008) asserts that no matter how big or small the corporation, it can use the six sigma approach.

2.3 Process Improvement Methodologies

The Toyota Production System (TPS), as noted by Dahlgaard and Dahlgaard-Park (2006), was a human-based system where people were involved in continuous improvement. The history of the process improvement philosophies lies within TPS and

the Japanese manufacturing industry and the roots of TQM can be traced back to the Japanese quality evolution (Dahlgaard & Dahlgaard-Park, 2006). The philosophies of TQM and lean only started to be used by Western companies during the late 1980s but Bendell (2006) argues that they have been to a large extent moulded in North America. The use of these philosophies in the 1980s as asserted by Dahlgaard and Dahlgaard-Park (2006) is partly because the West woke up and began to study what happened in Japan.

2.3.1 Lean Thinking

Dahlgaard and Dahlgaard-Park (2006) argue that there is a need for reducing waste … in any company … public as well as private. Womack and Jones (2003) assert that lean thinking is a powerful antidote to muda, which is the Japanese word for waste. They define waste as any human activity which absorbs resources but creates no value. Some of the key principles of lean, as identified by Womack and Jones (2003), include the elimination of muda, the identification of the value stream, and the continuous pursuit of perfection. Dahlgaard and Dahlgaard-Park (2006) found that this concept of muda became one of the most important concepts in quality improvement activities and as a result systems were developed to reduce muda including five-S, the theory of constraints (TOC), just-in-time (JIT) or Kanban system. In order to achieve the lean principles Bendell (2006) asserts that it is common to include a combination of techniques from these approaches. An organisation that uses these techniques must beware as Bendell (2006) asserts that the use of techniques alone does not in itself constitute being a lean organisation. Similarly Blokdijk (2008) argues that putting six sigma on the scene itself does not mean that there is nothing to do anymore.

2.3.2 Total Quality Management (TQM)

As with six sigma and lean, TQM also varies in its definition. Finlow-Bates, Visser and Finlow-Bates (2000) note that problem solving lies at the heart of TQM whereas Klefsjö et al. (2001) regard TQM as a management system consisting of values, methodologies and tools that aim to improve customer satisfaction with a reduced amount of resources. Management and TQM are also linked by Dahlgaard and Dahlgaard-Park (2006) who describe TQM as a holistic management philosophy rather than as a process improvement philosophy. Cao, Clarke and Lehaney (2000) argue that process change is

central to the concept of TQM and as such TQM could be considered as a facet of change management. Irani, Sharp and Kagioglou (1997) assert that is it widely accepted that TQM is likely to succeed within those organisations that plan and accept change as part of their daily lives.

Sousa-Poza, Nystrom, and Wiebe (2001) assert that implementation of the philosophy of TQM is more difficult because it requires alignment in the way the members of the organisation think and behave. Irani et al. (1997) concur that TQM involves the concerted effort of all employees and that the organisation must have an atmosphere of teamwork, promoted by committed senior management. Cao et al. (2000) note that TQM emphasises that each step of the production process is seen as a relationship between a customer and a supplier (whether internal or external to the organisation) and it is at each of these process steps that an organisation can focus on the improvements or changes that can be made. Gore (1999) asserts that process improvement is clearly an element of TQM and process improvement is not limited to small, incremental improvements. Where more fundamental changes or improvements are required an organisation may consider Business Process Re-engineering (BPR) instead of or as well as TQM, although Gore (1999) notes that the elements of TQM that are missing from reengineering are continuous improvement. González-Benito, Martinez-Lorente, and Dale (1999) argue that a company can apply TQM and BPR simultaneously and that this can yield more improvements than if only one of these techniques was used on its own.

2.3.3 Organisational Culture and Leadership

Irani et al. (1997) assert that the ability of an organisation to accept and encourage change, is almost always determined by the culture of the organisation therefore when an organisation adopts any process improvement methodology the company must establish the right culture to support their use in the change process. Although Sousa-Poza et al. (2001) argue that it is unlikely that a company can change its culture merely by deciding to implement TQM, the implementation and the corporate culture changes are likely to occur simultaneously. Whether a company is adopting a six sigma, lean or a TQM roadmap for it's quality journey, Dahlgaard and Dahlgaard-Park (2006) assert that these roadmaps are very dangerous to adopt without the right company culture. This culture must be present throughout the organisation and Blokdijk (2008) asserts

that the essential tool to six sigma success is the ability to build an effective infrastructure. This established company culture and infrastructure must be established, as asserted by Dahlgaard and Dahlgaard-Park (2006), from the top management level to middle management and to the shop floor level. Although Burnes (2004) warns that any attempt to change an organisation's culture is inevitably going to be met with resistance.

Cao et al. (2000) argue that TQM is mainly concerned with process change, whilst addressing to a lesser extent cultural change. The TQM management tools can be applied without culture change as the application, as asserted by Sousa-Poza et al. (2001), can be relatively straightforward since it requires limited modification in attitude and behaviour. However, Gore (1999) supports the idea that TQM provides a framework for building an organisational culture that will equip an organisation to continually learn and improve. The TQM philosophy as asserted by Stone (1996) extols a culture that involves a focus on teamwork, a participative style of management, good communications and employee involvement.

The early process improvement systems, such as TPS, were found by Dahlgaard and Dahlgaard-Park (2006) to have leadership and empowerment through education and training at the foundation of the system. Dahlgaard and Dahlgaard-Park (2006) assert that the essence of TQM, lean production and six sigma quality may be boiled down to leadership. Womack and Jones (2003) concur that a leader – someone who will take personal responsibility for change – is essential. In order for TQM to be successful it is noted by Sousa-Poza et al. (2001) that it is dependent on leadership that is sensitive to local needs and adaptive to cultural conditions. Although leadership could be considered as an essential element with six sigma, Blokdijk (2008) argues that teamwork and cooperation are a must to be able to come up with tangible results. Womack and Jones (2003) assert that the change agent doesn't need detailed lean knowledge at the outset but instead a willingness to apply it. Organisations may choose to use a company wide training program when introducing a process improvement methodology which Dahlgaard and Dahlgaard-Park (2006) note assures that all people understand the what, how and why both at the overall level, the group level and the individual level.

2.4 Change

Burnes (2004) asserts that change has always been a feature of organisational life and therefore most organisations, as well as most people, face changes at some point in their life. Siegal et al. (1996) state that change is also a fact of life. Hayes (2007) suggests that these changes can be large or small, evolutionary or revolutionary, sought after or resisted. Pardey (2007) argues that change is inevitable as new technologies, new social structures and new trading mechanisms transform the workplace. The paradigms of change, the reasons for change and resistance to change must therefore be considered to understand the nature of change and the management of the change process. Effective management of the change process is essential and as such Hughes, Ginnett and Curphy (2009) note that change is an important component of leadership.

2.4.1 Paradigms of Change

When considering the nature of change there are two paradigms that can be considered which are the punctuated equilibrium paradigm and the gradualist paradigm. Hayes (2007) states that the punctuated equilibrium paradigm has the following components: relatively long periods of stability (equilibrium), punctuated by compact periods of qualitative, metamorphic change (revolution). Although Burnes (2004) notes that some writers have argued that it is now the periods of stability which are brief and the revolutionary change periods which are long. The revolutionary approach to change is explained by Gilgeous (1997) as often planned by a few people and implemented in a rapid manner by those who agree with the changes or those who are coerced to do so.

Hayes (2007) states that the gradualist paradigm posits that fundamental change (organisational transformation) can occur through a process of continuous adjustment and does not require some major discontinuous jolt to the system in order to trigger a short period of revolutionary change. This paradigm is similar to that described by Gilgeous (1997) as an evolutionary approach where there is a need to be comfortable with each new situation before moving onto the next stage. These paradigms are similar to the continuous transformation model of change and is it argued by Burnes (2004) that in order to survive organisations must develop the ability to change themselves continuously in a fundamental manner. Johnson, Scholes and Whittington (2008) concur as they note that it is beneficial for change in an organisation to be incremental.

Burnes (2004) notes that the underpinning rationale for this model is that the environment in which organisations operate is changing. As the business environment changes and competition within the pharmaceutical industry increases, pharmaceutical businesses must recognise that they need to do things differently in addition to doing different things and that change can be as a result of continuous improvement which could be a planned approach as opposed to being a reactive approach to change.

There are a number of models for process change, along with these paradigms for change, which can be considered by an organisation as approaches to change management. A model of change that could be considered is the emergent approach to change. Burnes (2004) argues that in this approach change is a continuous, dynamic and contested process that emerges in an unpredictable and unplanned fashion which contrasts with the planned approach to change. Although Burnes (2004) asserts that the emergent perspective rejects … approaches such as TQM and BPR.

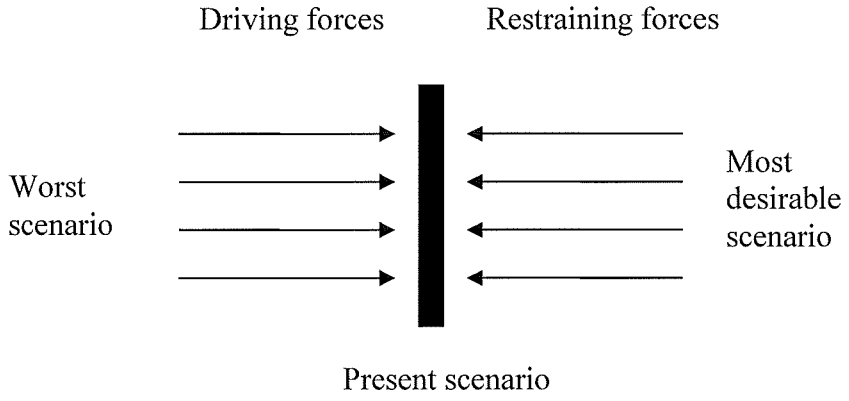
2.4.2 Reasons for Change

Kotter and Schlesinger (2008) state that a mistake managers make is to approach change in a disjointed and incremental way that is not part of a clearly considered strategy. However many organisations, as noted by Cicmil (1999), define their change initiative as strategic. Strategy can be formulated by an organisation through an understanding of the competitive forces and analysing the industry's underlying structure in terms of the five forces that shape industry competition (Porter, 2008). Mintzberg (1987) asserts that strategies can form as well as be formulated, therefore strategies may change over time as a situation evolves. Beer and Eisenstat (1996) state that corporations will have to learn to reformulate strategy and realign their organisations continuously if they are to survive in an increasingly turbulent environment. Feurer and Chaharbaghi (1997) argue that organisations are … constantly changing their strategies. Through communication of the strategy for change Burnes (2004) asserts that members of the organisation come to appreciate that change is not only inevitable but it is being taken to safeguard, rather than threaten, their future.

Lewin (as cited by Huczynski & Buchanan, 2001) argues that the nature and pace of change depends on the balance of driving and restraining forces in relation to a particular change. Burnes (2004), when considering Lewin's field theory, notes that to

bring about change the forces for change must be strengthened whilst the forces for stability must be reduced. This force-field analysis (see Figure 1) can be used by the change agent to identify and understand the forces that drive or resist a change and Hayes (2007) argues this can provide a useful basis for developing action plans to secure the desired change.

Figure 1: A force-field



Source: Adapted from Hayes, J. (2007). *The Theory and Practice of Change Management* (Second ed.). Basingstoke: Palgrave Macmillan.

Hartley (2002) argues that there are four main sets of influences on organisational change which are; the context in which organisational change takes place; the leadership and key agents influencing or reacting to change; the management of change processes; and the outputs and outcomes of change for different stakeholders. Huczynski and Buchanan (2001) commented that the need for organisational change can be prompted or initiated by many different triggers. The external triggers identified include developments and changes in technology, the activities of competitors, new products and new government legislation or policies (Kotter & Schlesinger, 2008; Huczynski & Buchanan, 2001; Gilgeous, 1997). The external context in which organisational change takes place, as described by Hartley (2002), provides pressures, constraints and opportunities for organisational change. Kumar et al. (2008) assert that companies around the world are facing today the harsh realities of a competitive environment and that they do not have the time to wait and bring about evolutionary change. Organisations as argued by Beer, Eisenstat and Spector (1990) are faced with changing markets and increased competition and more companies are struggling … to ensure their survival. The goal of many organisations as observed by Kotter (1995) is to make fundamental changes … to cope with this new, more challenging market environment.

Although Sull (1999) notes that when successful companies face big changes in their environment, they often fail to respond effectively.

Gilgeous (1997) states that organisations that do not change due to ignorance will be the first to fail, therefore a company should understand the environment in which it is competing. Martin (2007) notes that there are few industries that are immune to shifting competition bases. Kotter (1995) argues that successful change efforts begin when some individuals start to look hard at a company's competitive environment, market position, technological trends, and financial performance. The tools that can be utilised for this process include a PESTLE or a SWOT analysis which for any company detail the internal influences as well as some of the external influences, such as political pressures, which could take the form of priorities for government spending, economic pressures which could come from increased competition and social pressures coming from the demographic change towards an ageing population. An analysis of the business by means of a PESTLE analysis should not be a one off event as Gilgeous (1997) warns that for organisations to survive and excel they must constantly scan what is happening in their area of business. Therefore one area of focus for the pharmaceutical industry could be, as noted by Kotter (1995), the potential revenue drop when an important patent expires.

The activities of competitors that may trigger change as well as being external could also be due to internal competition, such as different divisions or manufacturing sites of an organisation that could be competing for investment. As such if an individual business unit is successful in implementing change this could be utilised as a change model within the organisation. However, Beer et al. (1990) argue that these models can serve as catalysts for change only if others are aware of their existence and are encouraged to learn from them. Burnes (2004) concurs that companies should publicise the projects that are seen as models of how to undertake change and the positive effects that change can have for employees.

Some of the internal triggers identified by Huczynski and Buchanan (2001) include the appointment of a new senior manager, recognition of problems, triggering reallocation of responsibilities and innovations in the manufacturing process. Beer et al. (1990) argue that the starting point for any effective change effort is a clearly defined business problem. Triggers that point companies in the direction of change projects, such as

outsourcing, are specifically identified by Kippenberger (1997) as business process re-engineering, organisational restructuring, benchmarking and alliance.

2.4.3 Resistance to Change

Strebel (1996) states that managers and employees view change differently. Gilgeous (1997) asserts that those managing change must be aware of the nature of the resistance they will face from people within the organisation but Kotter and Schlesinger (2008) found that surprisingly few managers take time, before an organisational change, to assess systematically who might resist the change initiative and for what reasons. This may explain why Diefenbach (2007) found that people were surprised and puzzled by the fact that there is resistance. The four most common reasons that people resist change as found by Kotter and Schlesinger (2008) are; a desire not to lose something of value, a misunderstanding of the change and its implications, a belief that the change does not make sense for the organisation, and a low tolerance of change.

The organisational resisting forces could include a lack of resources to complete the change within its original time scales, the culture of the business division and the threat to the allocation of resources. Gilgeous (1997) argues that the culture of an organisation may pose a barrier to change. The time scales for the change are also important and it must be visible to those involved in the change process from the early stages that the change is producing results. This is argued by Kotter (1995) who asserts that without short-term wins, too many people give up or actively join the ranks of those people who have been resisting change. Burnes (2004) argues that resistance can be viewed as positive as it can force an organisation to review its change process to establish if something is wrong with the process.

Burnes (2004) asserts that for many people, change involves moving from the known to the unknown with the possibility of loss as well as gain. The fear of the unknown and the loss of the old without the knowledge of what the new will bring causes the fear in people (Leahy & Chamberlain, 2008). A loss, as a result of change, may impact on an individuals psychological contract, in other words the unwritten set of expectations between an individual and the organisation of which they are a member of. The individual resistance to change could include a lack of understanding as to why the change is required; the potential loss of current skills as well as the fear of the unknown.

Ansoff (1998) asserts that individuals will resist change when it makes them insecure. However Kegan and Lahey (2001) note that what looks like resistance may in fact be a kind of personal immunity to change. Strebel (1996) argues that for may individuals change is neither sought after or welcomed. Organisational members in a study by Holt, Self, Thal and Lo (2003) were able to conclude that the change was not appropriate … because a clear reason for the change was never established and resistance to the concept of change was only natural. A reason for the change should therefore be communicated and Burnes (2004) argues that openness helps people to understand the need for change. Gilgeous (1997) asserts that the barrier to change can lie within every person and Beer et al. (1990) note that some people just cannot or will not change, despite all the direction and support in the world.

2.4.4 Management of the Change Process

Burnes (2004) asserts that whether the need for change arises from an organisation's strategy or emerges in some other way … it is necessary to plan how this will be achieved and then to implement the plan. The management of the plan for change and the skills and time required to implement it must therefore be considered. The successful change process moves through a series of stages that usually require a considerable length of time as change occurs slowly (Gilgeous, 1997; Kotter, 1995). Burnes (2004) concurs that change can be a slow process as well as a difficult one. Beer et al. (1990) argue that most change programs don't work because they are guided by a theory of change that is fundamentally flawed. Gilgeous (1997) asserts that for most organisations change is difficult and complex to manage furthermore Beer and Nohria (2000) concur that few companies manage the process as well as they would like. In addition Wheelwright and Hayes (1985) assert that managing change in an established operation is always difficult.

When managing organisational change the interrelated factors of coordination, commitment and competency should be considered and it is argued by Beer et al. (1990) that if any of these elements are missing, the change process will break down. These factors are related to those stated by Gilgeous (1997) who asserts that the manager of the change must plan carefully for the change, skilfully introduce it, and handle resistance. The manager of the change process may be an individual change agent or they may be part of a change management team that includes change sponsors and

change champions. Gilgeous (1997) describes a sponsor as those who have the authority and responsibility for change whereas a champion plans and supports these changes. If a team approach to change is to be utilised then Burnes (2004) argues that it is necessary to have the right blend of skills for the change being undertaken, including the ability to deal with the unexpected. Beer et al. (1990) assert that coordination or teamwork is especially important if an organisation is to discover and act on cost, quality and product development opportunities.

These teams must also be motivated as Kotter (1995) asserts that without motivation, people won't help and the effort goes nowhere. Burnes (2004) states that for most kinds of change success depends on winning the commitment of key staff. Beer et al. (1990) argue that high levels of commitment are essential and Kotter (1995) concurs that major change is impossible unless the head of the organisation is an active supporter and therefore committed to the change process. Senge (1999) argues that change can only be initiated by small groups of thoughtful leaders who truly desire to build an organisation where people are committed to a larger purpose. As the change process progresses then more and more people within the organisation must be committed to the process of change and form a powerful leadership coalition to support the process (Kotter, 1995). It is this coalition, as argued by Kotter (1995), that must develop a picture of the future that is relatively easy to communicate and appeals to customers, stockholders and employees.

Training in new skills and competencies may be needed by those involved in the change process, furthermore Burnes (2004) asserts that management and staff development programmes can provide the human resources necessary for managing change. Whilst Holt et al. (2003) note that organisational leaders used classroom training as they initiated change. Beer et al. (1990) state that competencies such as the knowledge of the business as a whole, analytical skills and interpersonal skills are necessary if people are to identify and solve problems as a team. These interpersonal skills can be used to drive the change process and to aid the communication of the change throughout the organisation as Kotter (1995) asserts that without credible communication, and a lot of it, the hearts and minds of the troops are never captured. Burnes (2004) states that in an ideal world, organisations would want everyone to buy into a change project although Kotter (1995) notes that gaining understanding and support is tough when downsizing is part of the vision for the change process. Leadership is an important element of change

and the leaders within an organisation need to be conscious of their communication, both verbal and non-verbal, of the change. Gilgeous (1997) states that the persons directing the change must believe the change is necessary. Kotter (1995) warns that nothing undermines change more than behaviour by important individuals that is inconsistent with their words. These behaviours could also include the perceptions of behaviours by those within the organisations and the extent to which one perceives formal and informal leaders in the organisation support the change (Holt et al., 2003).

The culture of an organisation is important and Gilgeous (1997) argues that if organisations do not have a culture which matches how they wish to operate in the future, they must create one. Burnes (2004) notes that a successful culture is one based on values and assumptions appropriate to the environment in which it operates. The culture of an organisation can impact it's ability to change and it is argued by Kotter (1995) that until changes sink deeply into a company's culture ... new approaches are fragile and subject to regression. Helms and Stern (2001) found that subcultures exist and therefore those managing the change process need to consider that subcultures exist in a complex and potentially conflicting relationship with the dominant culture of the organisation (Burnes, 2004). Sadri and Lees (2001) argue that the dominant culture in the organisation must be strong enough for members of various subcultures ... to identify with, accept and embrace it.

Kotter (1995) asserts that change sticks when it becomes the way we do things around here although Brooks (1994) argues that this is only likely to occur following a change in culture. For change to be institutionalised within the organisation then Kotter (1995) argues that there are two factors which are important. One of these factors is an attempt to show people how the new approaches, behaviours and attitudes have helped improve performance. The second factor is to make sure that the next generation of top management really does personify the new approach and this can be influenced by both recruitment and leadership development. These factors can be linked to Schein's approach to the development of culture (as cited by Burnes, 2004) that emphasises the way in which an organisation communicates its culture to new recruits.

2.5 Conceptual Model

The research takes the concepts and theories introduced earlier in Chapter 2 and utilises the relevant aspects of these theories to create a conceptual model, as shown in Figure 2, that will be used by the researcher to answer the research question.

The model starts at the base of the pyramid with the process improvement methodologies of TQM, Lean and Six sigma (linked into references 5, 6 and 7 on the conceptual model), (Blokdijk, 2008; Kumar et al., 2008; Bendell, 2006; Dahlgaard & Dahlgaard-Park, 2006; Womack & Jones, 2003; Klefsjö et al., 2001; Gore, 1999). The three methodologies will be used to ascertain as to whether six sigma is seen as a new or a different methodology.

The pyramid is formed by building upon the base of the improvement methodologies with the process improvement tools along with the training programs (linked into references 3 and 4 on the conceptual model), (Antony, 2007; Bendell, 2006; Carreira & Trudell, 2006). The model will be utilised to establish how the process improvement tools have been utilised for change projects by those who have attended process improvement training programs. The researcher will also utilise the model to understand the roll-out of the six sigma training program within the organisation as well as to discover those who have previously been trained in process improvement.

The final building block at the top of the pyramid is the people and the teams (linked into reference 2 on the conceptual model), (Blokdijk, 2008; Antony, 2007; Buch & Tolentino, 2006; Dahlgaard & Dahlgaard-Park, 2006; Womack & Jones, 2003; Knippen & Green, 1997; Irani et al., 1997; Stone, 1996). The model will be used to ascertain the perceptions of the people involved with six sigma and change management.

The concepts above are all facets of the change management process and as such are captured within the pyramid that represents change (linked into reference 1 on the conceptual model), (Kotter & Schlesinger, 2008; Kumar et al., 2008; Burnes, 2004; Womack & Jones, 2003; Hartley, 2002; Huczynski & Buchanan, 2001; Cao et al., 2000; Irani et al., 1997; Gilgeous, 1997; Stone, 1996; Kotter, 1995; Beer et al., 1990). The model will be used to ascertain how the process improvement methodologies relate to

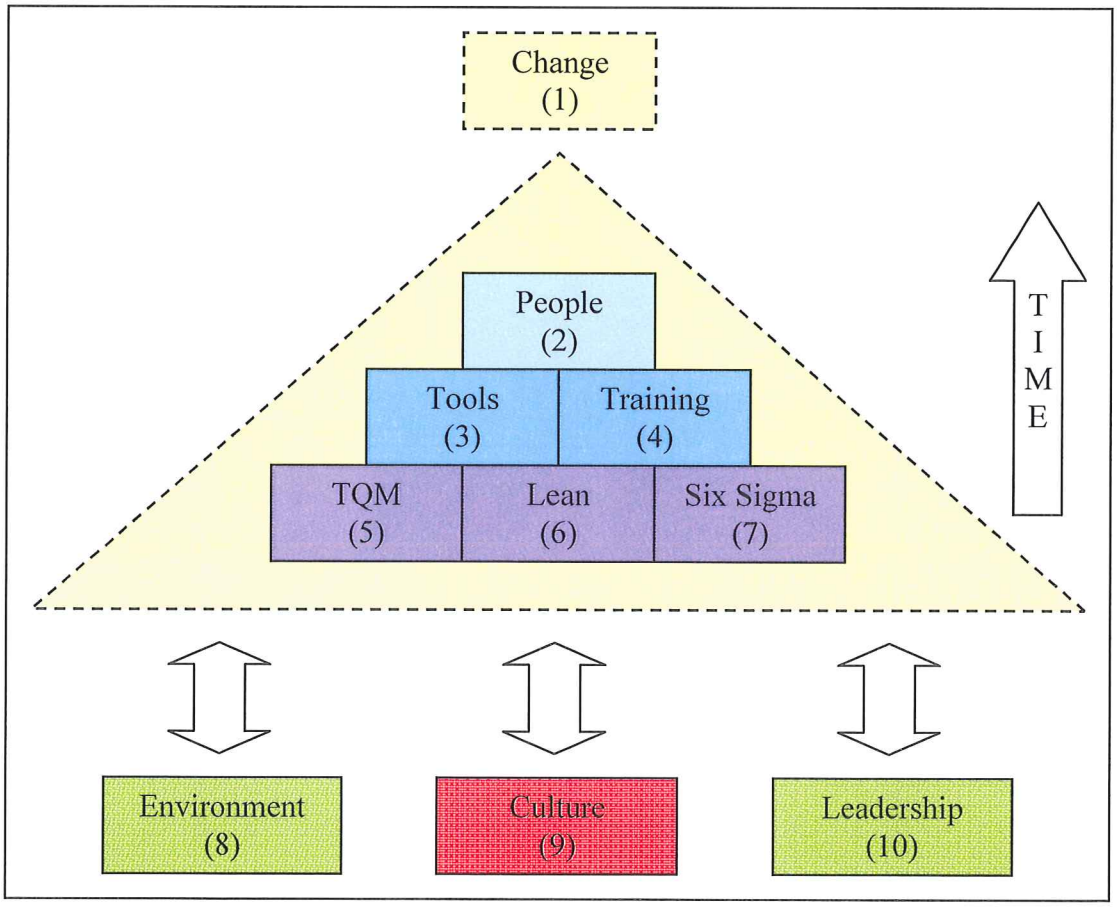
the change management process and to understand the reasons for and resistance to change.

The conceptual model also focuses on the implementation of the process improvement methodologies as a facet of change over a period of time, as shown by the upward arrow of 'time' in the model (Gilgeous, 1997; Kotter, 1995).

To further understand the reasons for change and resistance to change, the conceptual model also looks at the concepts of environment, culture and leadership (linked into references 8, 9 and 10 on the conceptual model) as factors that can be drivers for change or reasons for resistance to change which are shown on the model by the two way arrows.

This conceptual model will form the basis for the questions in the semi-structured interviews and the model also forms the basis for the design of the questionnaire.

Figure 2: The conceptual model



2.5.1 Links to the numbered reference on each element of the conceptual model

(1) Change (Kotter & Schlesinger, 2008; Kumar et al., 2008; Burnes, 2004; Womack & Jones, 2003; Hartley, 2002; Huczynski & Buchanan, 2001; Cao et al., 2000; Irani et al., 1997; Gilgeous, 1997; Stone, 1996; Kotter, 1995; Beer et al., 1990).

(2) People (Blokdijk, 2008; Antony, 2007; Buch & Tolentino, 2006; Dahlgaard & Dahlgaard-Park, 2006; Womack & Jones, 2003; Knippen & Green, 1997; Irani et al., 1997; Stone, 1996).

(3) (4) Tools and Training (Antony, 2007; Bendell, 2006; Carreira & Trudell, 2006).

(5) (6) (7) TQM, Lean, Six sigma (Blokdijk, 2008; Kumar et al., 2008; Bendell, 2006; Dahlgaard & Dahlgaard-Park, 2006; Womack & Jones, 2003; Klefsjö et al., 2001; Gore, 1999).

(8) Environment (Kotter & Schlesinger, 2008; Porter, 2008; Burnes, 2004; Cicmil, 1999; Feurer & Chaharbaghi, 1997; Beer & Eisenstat, 1996; Beer et al., 1990; Mintzberg, 1987).

(9) Culture (Dahlgaard & Dahlgaard-Park, 2006; Burnes, 2004; Sousa-Poza et al., 2001; Helms & Stern, 2001; Sadri & Lees, 2001; Cao et al., 2000; Gore, 1999; Irani et al., 1997; Gilgeous, 1997; Stone, 1996; Kotter, 1995; Brooks, 1994).

(10) Leadership (Blokdijk, 2008; Dahlgaard & Dahlgaard-Park, 2006; Burnes, 2004; Womack & Jones, 2003; Holt et al., 2003; Sousa-Poza et al., 2001; Senge 1999; Irani et al., 1997; Gilgeous, 1997; Stone, 1996; Kotter, 1995; Beer et al., 1990).

2.6 Summary

The relevant literature that impacts upon this research has been outlined within Chapter 2. The research has examined the literature relating to six sigma along with both TQM and lean as well as referring to the other available process improvement methodologies. The literature on change management has been reviewed along with the paradigms of change, the reasons for change and the reasons for resistance to change. The concepts and theories from Chapter 2 have been utilised to design a conceptual model which will be used by the researcher to answer the research question. Chapter 3 will discuss the research methods and the research instruments based upon the conceptual model.

3 Methodology

3.1 Introduction

An outline of the methodology and the philosophy utilised for the research will be discussed in this chapter. The research strategy chosen and the justification for its use within this research will be examined. The design of the research will be considered along with the links to the literature detailed within Chapter 2. The procedure employed for administering the research will also be reviewed.

3.2 Research Philosophy

The philosophy selected for the research is a phenomenological approach, also known as interpretivism or constructionism. This philosophy is chosen as this takes into account that reality is influenced by the values of society and the way that it sees the world (Fisher, 2007). Easterby-Smith, Thorpe and Jackson (2008) argue that for this approach reality is socially constructed and given meaning by people. The interpretive philosophy is a gnostic rather than an orthodox approach to research and Fisher (2007) states that this is because it does not accept the existence of an orthodox or standard interpretation of any particular topic.

The justification for selecting this approach is due to the axiology and experience of the researcher. Saunders, Lewis and Thornhill (2009) comment that the axiology of an interpretivism research philosophy is one where the researcher is part of what is being researched, cannot be separated and so will be subjective. As the researcher is an employee of the organisation, is trained in both the six sigma and the change management process and is involved with these processes on a regular basis within PCN, then the researcher's axiology concurs with the interpretivism research philosophy.

The approach to the research is a combined approach and initially uses deductive theory as Saunders et al. (2009) argue that this emphasises both the move from theory to data and also the need to explain causal relationships between variables. The research approach then makes use of induction to build the theory as this approach emphasises the human factor and therefore the perceptions of those within the organisation to both

the change management process and the six sigma process. The induction research approach is also appropriate as the researcher is closely involved with both of these processes at PCN and in addition this approach emphasises the collection of qualitative data.

3.3 Research Strategy

3.3.1 Justification for the selected paradigm and methodology

In order to define the research strategy a number of research methods were reviewed to determine if they are appropriate to answer the research question under consideration. The research strategy chosen to answer the research question is a combined approach consisting of semi-structured interviews and a questionnaire. These qualitative research methods are chosen as they are aligned with the phenomenological approach to the research.

A non-probability approach to sampling is utilised for the research. The sample size is chosen so as to be representative of those directly involved with six sigma and change. This sampling approach is judgment sampling, which is a type of purposive sampling, which Sekaran (2003) describes as sampling that involves the choice of subjects who are most advantageously placed or in the best position to provide the information required. This approach is described by Fisher (2007) as identifying the people who have the answers to the questions you want to ask. The sample group includes representatives who work within the global organisation as a number of the six sigma trainers are based at the PCN sites in both Europe and the United States of America.

The research strategy is to conduct semi-structured interviews first utilising a small sample group in order to assist in the design of the questionnaire. The questionnaire is then piloted with a small group and any modifications completed prior to distribution to a wider audience. This ensures that the questionnaire is a reliable instrument to aid with the research. The distribution list for the questionnaire is initially focused on personnel within a manufacturing site based within the UK as opposed to a wider audience of personnel from multiple sites. The research approach makes certain that anonymity of the respondents is kept throughout the research to aim for truthful responses to be obtained.

The study for this research consists of a cross-sectional study, described by Saunders et al. (2009) as the study of a particular phenomenon (or phenomena) at a particular time. This approach is appropriate as it captures a particular time in the six sigma and change management process as well as meeting the time lines associated with this research process. The six sigma process has been rolled out to the global PCN organisation during the last eighteen months and the research will plan to capture the impact of this six sigma initiative on the change management process following the first phase of the implementation.

3.3.2 Rejected Methods

The research methods that are rejected are detailed below along with the reasons why the researcher chose not to use these methods.

Focus groups are rejected as a research method as the researcher feels that the focus groups would not provide responses from all of those invited to attend the focus group due to the personalities of the individuals and the willingness of the participants to volunteer their opinion in a group setting. Easterby-Smith et al. (2008) assert that social pressure can condition the responses gained and … people are not willing to air their views publicly. The researcher is also concerned that the focus group approach requires an experienced facilitator to get the most out of the session and to ensure that the session does not end up focussing on the negative experiences of six sigma and change management.

Unstructured interviews are also rejected as a research method due to the experience of the researcher as an interviewer. The researcher is aware that without a structure to the interview the discussion may cover some interesting points but may deviate from the key points of the research topic under discussion. A more structured interview approach is also required to help with the design of the questionnaire.

The distribution of the questionnaire to a wider audience encapsulating the multiple sites of the business is rejected for a number of reasons. The multiple sites cover a number of different languages and the researcher is therefore concerned that the research concept and questions may get lost in translation. The researcher also notes that

the impact of the culture of the multiple sites may be difficult to assess through the use of a self-administered questionnaire and as a result the researcher is concerned with the external validity of the questionnaire.

The use of a questionnaire administered by post is rejected as the focus of the research is on the six sigma program and the change management process within the researcher's organisation therefore the research is focussed on the internal processes and procedures.

3.4 Research Design

3.4.1 Design of Instruments

The questions utilised for the semi-structured interviews are based upon the supporting literature and the conceptual model detailed within Chapter 2 of the research. The semi-structured interviews are used to help with the design of the questionnaire. Appendix 1 tabulates the questions from the questionnaire and links each question to the supporting literature or the conceptual model. A draft version of the questionnaire is used as the basis for the interview questions in order that the researcher can probe around the general topics with the interviewees to understand which areas require further questions to be added to the questionnaire. This approach concurs with Fisher (2007) who asserts that for semi-structured interview the interviewer has a schedule to remind them of the main issues and topics that need to be covered. This approach also allows the researcher to start the discussion with open questions in order to gain the perspectives of those being interviewed on the research topic. The researcher subsequently uses follow up questions, as appropriate, to allow for the flexibility to continue questioning around a particular area of interest and to draw out more information from the interviewees as required. This is in line with the interview approach suggested by Easterby-Smith et al. (2008) where some deviation from the sequencing of the questions is allowed in order to follow interesting lines of inquiry. The interviewees selected are from the group of master black belts employed by the organisation as this group are responsible for the global roll out of the six sigma training programme and, in addition, have an oversight of all the six sigma change projects. Saunders et al. (2009) found that managers are more likely to agree to be interviewed rather than complete a questionnaire and therefore those chosen from the group to be interviewed are managers from within the organisation.

Following the completion of the semi-structured interviews the design of the questionnaire is reviewed, draft questions are modified and additional questions added. The questionnaire is then piloted with a small group and further modifications are finalised prior to the distribution to a wider audience consisting of a sample group of those who were trained in the six sigma process at least six months prior to receiving the questionnaire. As with the semi-structured interviews the questions utilised for the questionnaire are based upon the supporting literature and the conceptual model detailed within Chapter 2 of the research. The questionnaire design consists mainly of pre-coded questions with multiple choice answers as well as some open questions where further details may be required from the respondent. The questionnaire draws upon the theory related to the six sigma tools and training programme. It also considers the drivers for change, resistance to change and the management of the change process, including the communication and the leadership associated with change. The culture of the organisation and the demographics of those completing the questionnaire are also considered.

3.4.2 Validity and Reliability

In order to attempt to reduce any subject bias, within both the semi-structured interviews and the questionnaire, it is highlighted in advance to all participants that their responses remain anonymous. Those selected for the interview process or selected to complete the questionnaire are also made aware that their responses are for research purposes only as opposed for use within the organisation. The researcher recognises that despite this the respondents may answer the questions assuming a response that does not reflect negatively on the organisation and therefore notes concern regarding the validity of the responses.

The use of a small number of interviewees along with a small group being selected to complete the questionnaire was considered reliable as Easterby-Smith et al. (2008) argue that the use of the constructionism philosophy requires a sampling approach of a small number of cases chosen for specific reasons. Although Fisher (2007) asserts that if samples are small, or used to generate qualitative material rather than numbers then the question of whether the findings are transferable can only be answered by

judgement not by calculation therefore the researcher must make note of them when drawing out any conclusions from the responses.

3.5 Research Procedures

The procedure for the administration of the research instruments as part of the research process is discussed further. The questions used in the semi-structured interviews are based upon the draft version of the questionnaire. The questions start with open questions based upon the general research areas and then further probing questions are used dependant on the responses given. The discussions are used in order to gain the perspectives of the interviewees on the progress of the six sigma training programme and the change management process within the organisation.

Two managers are selected for the interview process from within the group of master black belts employed by the organisation. Both the selection of the interviewees and the timings for the interviews are based upon the availability of the individuals. Both of the individuals are part of a group who are responsible for the global roll out of the six sigma training programme and as such spend a large proportion of their time at the other facilities within the organisation outside of the UK. As the researcher aims to conduct face to face interviews and maintain personal contact with the individuals then the timing is based upon the availability of the interviewees at the site within the UK. The location selected for the interview is a neutral space away from the individuals offices to ensure privacy and also to reduce the distractions such as emails, telephone calls, etc. The use of a neutral space for interviewing people is recommended by Fisher (2007) as it can encourage them to open up and to challenge their own assumptions.

The questionnaire is initially administered as a pilot to a small group and based upon the responses further modifications are completed to finalise the design of the questionnaire prior to the distribution to a wider audience. The questionnaire can be found in Appendix 2. The questionnaire is administered via email to those internal candidates who are selected for the research. A reward for answering the questionnaire was considered by the researcher but this was discounted as the researcher wanted the individuals to be assured that their responses would remain anonymous and the difficulty of offering a reward in this situation is highlighted by Easterby-Smith et al. (2008). In addition the respondents are given three options for returning the completed

questionnaire. These are to email the completed questionnaire, to send a scan of the questionnaire directly to the researcher's email account or to post the completed questionnaire via the internal mail system. Only by emailing the questionnaire would the researcher be able to identify the individual respondents therefore returning questionnaires via email can make it more difficult to promise confidentiality convincingly (Fisher, 2007) hence why the researcher gave the respondents options for the return of their responses.

The group are selected from a sample group consisting of those who have been trained in the six sigma process at the green belt level at least six months prior to receiving the questionnaire. The time period of at least six months from the individuals having been trained to being selected to answer the questionnaire is chosen based upon the three waves of training that have been rolled at the UK site. These were conducted in phases with the initial training being conducted over twelve months ago and the second wave being completed approximately six months ago. The researcher acknowledges that in order to answer the questionnaire those chosen must have had a period of time in which to apply the training and as such those who had only recently received the training within the last couple of months would not have had enough time to complete any six sigma projects and are therefore discounted for the purposes of this research.

3.6 Ethical Considerations

The ethical considerations for this research process are due to the chosen research philosophy of a phenomenological approach. This is because the phenomenological approach involves the researcher as an employee of the organisation and as someone who is involved with both the six sigma and the change management processes on a regular basis within PCN. The researcher chose not to include any potential respondents who worked within the same department as the researcher or who reported either directly or indirectly to the researcher so as to ensure that individuals did not feel pressurised to respond to the questionnaire. This ethical consideration is raised by Saunders et al. (2009) who argue that individuals have a right to privacy and should not feel pressurised or coerced into participating.

The option of offering a reward for completing the questionnaire is considered unethical by the researcher as again this could have made individuals feel pressurised into

responding to the questionnaire and would not have protected the privacy of the individuals who are the subject of the research or ensured confidentiality. Fisher (2007) asserts that confidentiality means not revealing your sources and therefore the researcher refers to the responses received without revealing the names of any individuals that are known. The ethics of the research process also means that the researcher considered protecting the anonymity of the organisation and to achieve this the researcher has changed the name of the organisation throughout the research.

3.7 Summary

In this chapter the outline of the methodology and the philosophy utilised for the research were discussed. The research strategy chosen and the justification for its use within the research were examined along with the reasoning for rejecting other research methods. The design of the research was considered and the links to both the supporting literature and the conceptual model were discussed. The administration procedure employed for the research was reviewed along with the ethical considerations for the research.

4 Findings

4.1 Introduction

The fourth chapter will detail the findings of the research following the application of the methodology as described in Chapter 3. Chapter 4 will present the findings of the data collected and Chapter 5 will then provide the analysis of the data within the context of the literature as detailed within Chapter 2. The data collected from the questionnaire will be presented and where applicable histograms and pie charts will be utilised. These graphs will demonstrate any potential areas of interest which will then be explored further in Chapter 5.

4.2 Analysis of respondents and non-respondents

Semi-structured interviews were utilised to assist in the design of the questionnaire (Appendix 2) where two people were invited to be interviewed for the research due to their roles within the organisation. These individuals are involved with the roll-out of the six sigma training program across the multiple sites of the organisation and as a result have an overview of all the six sigma projects across the sites along with an insight to the progress being made. Both invitees agreed to be interviewed and are considered by the researcher to be representative of the sample group.

The six sigma questionnaire consists of 28 questions and in addition an open space at the end of the questionnaire was available for any additional comments or feedback from the respondents. The questionnaire was issued via email to the target group of sixteen personnel. The sixteen people invited to participate in the research consist of those who have been trained in the six sigma program at the green belt level at least six months prior to receiving the questionnaire. A total of eight people (50%) responded to the questionnaire within the specified time period. Once the time period had elapsed the researcher sent a further email to thank those who had responded and to prompt the non-respondents into responding. A further two people responded as a result of this prompt bringing the total number of respondents to ten out of sixteen, which is a 62.5% response rate.

Although the respondents were given the option of returning their completed questionnaires anonymously, only two out of the ten respondents chose to utilise the anonymous methods and therefore the researcher could identify the majority of those who had responded. The individuals who responded are employed across all four areas of the organisation identified and can therefore be considered representative of the sample group. Likewise those who did not respond to the questionnaire are also employed across all four areas of the organisation and the researcher concluded that there is nothing unusual about the behaviour of those who did not respond. As the researcher could not identify anything unusual about the non-respondents behaviour then there is nothing to suggest that the data collected from the correspondents cannot be analysed and considered valid.

4.3 Semi-structured interview outcomes

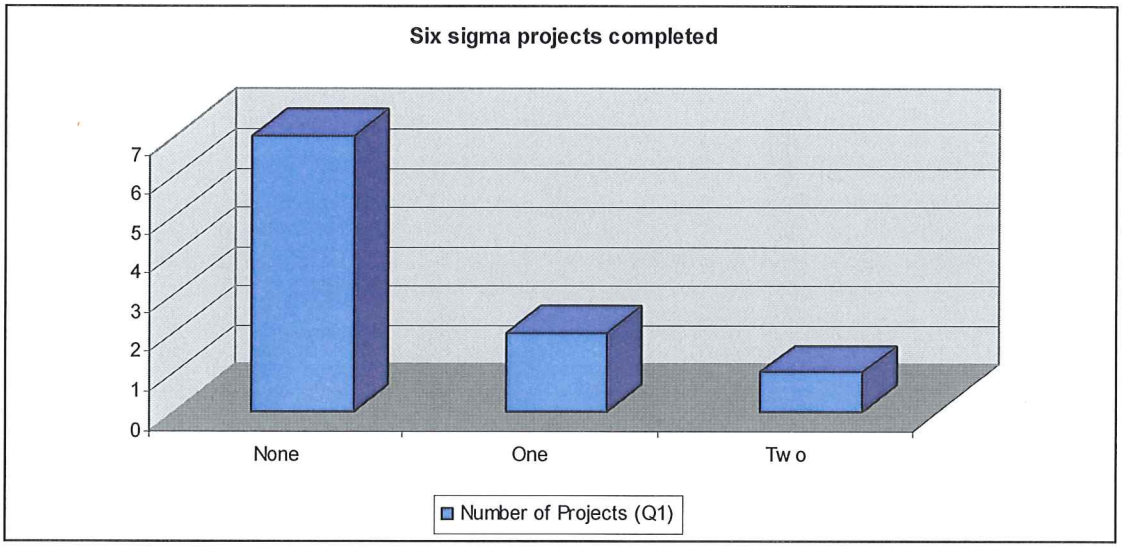
Two semi-structured interviews were conducted utilising a draft version of the questionnaire to assist in the design of the final version. As the interviews were semi-structured the researcher used open questions based upon the general research areas in the questionnaire and further probing questions dependant on the responses given. The researcher decided not to use a Dictaphone to record the interview and instead made notes of the key points discussed. The researcher was able to reflect upon the responses given in relation to the draft questionnaire and revise or add any questions as required. The key points from the interviews will be discussed further in Chapter 5 as part of the analysis of the data collected.

4.4 Questionnaire Findings

The questionnaire issued by the researcher consisted of 28 questions. The data collected from the questionnaire will be presented by utilising histograms and pie charts to demonstrate any potential areas of interest. For other areas of interest where the data can not be presented in a chart the responses to the question will be discussed.

The first question on the questionnaire was asked in order to understand how many six sigma projects had been completed by the respondent within the last 12 months. The results of the responses are detailed within Figure 3.

Figure 3: Number of six sigma projects completed



The chart in Figure 3 reveals that 70% of the respondents had yet to complete a project with only one respondent having completed more than one project. The researcher noted that a couple of those who responded 'none' did state that their projects were work in progress. Although the majority of the respondents had not completed a six sigma project at least eight of the ten respondents were able to detail the six sigma tools that they had used either in a project or used in their day to day job.

Question 4, as detailed within Figure 4, asked for information on awareness of the number of completed projects across the manufacturing site.

Figure 4: Awareness of the six sigma projects completed across the site

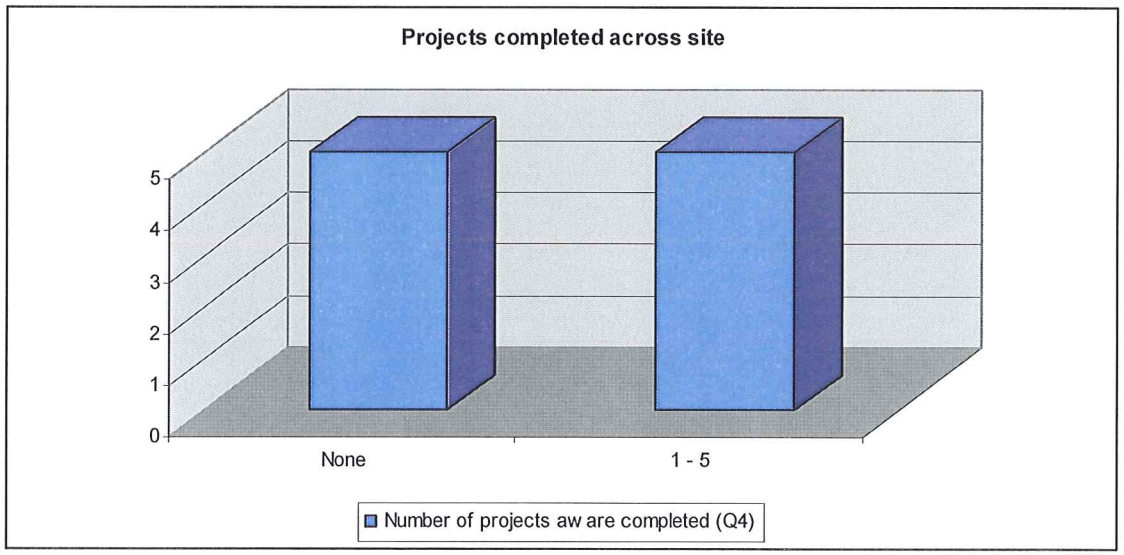
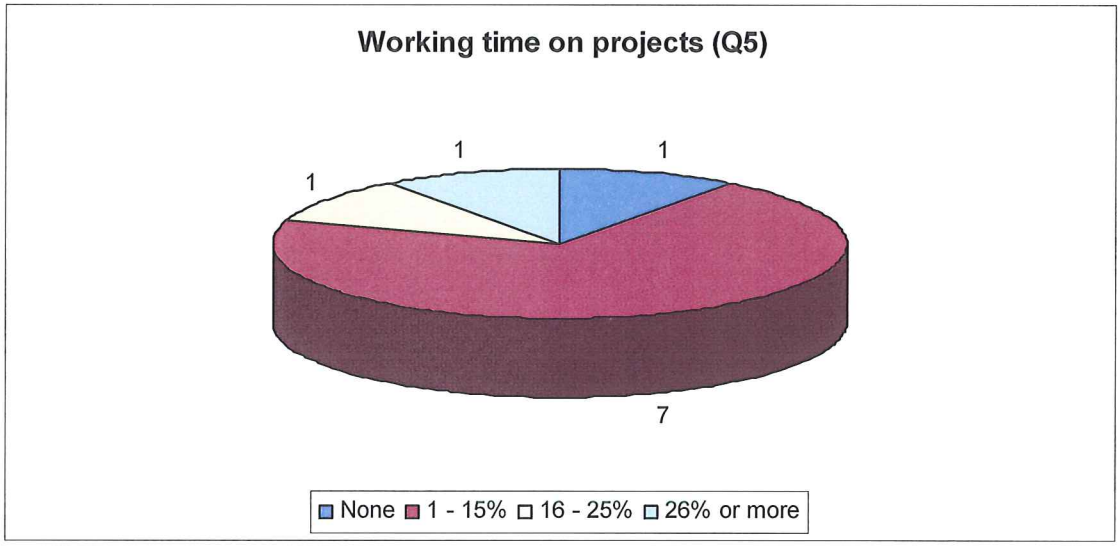


Figure 4 demonstrates that 50% of the respondents were not aware of any projects being completed and 50% were only aware of one to five projects being completed.

25% of the working time for six sigma green belts has been allowed for six sigma projects and as such question 5 asked how much of the respondents working time was given for them to work on their projects over the last twelve months. The results of the responses to this question are shown in Figure 5.

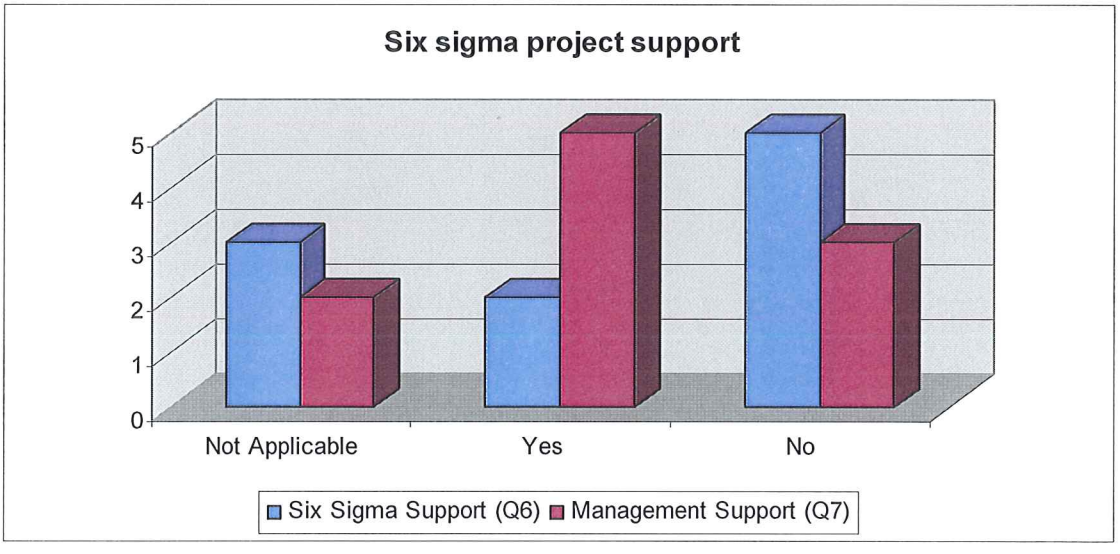
Figure 5: Time spent working on six sigma projects



The findings, demonstrated in Figure 5, show that seven out of the ten respondents (70%) spent from 1 – 15% of their time working on their six sigma projects. For the remaining categories of percentage of working time each category had one response.

Figure 6 demonstrates the responses to both question 6 and 7 regarding project support.

Figure 6: Support for six sigma projects



The chart in Figure 6 shows that two respondents (20%) received support from either their department black belt or from one of the global master black belts in order to work on their six sigma project. The same two respondents also received support from their team manager or department manager whereas the additional three respondents (30%) received only management support for their work.

The eighth and ninth questions focussed on the roll-out of the six sigma training program within the different areas of the organisation and whether those supporting the projects had received training with the responses being detailed within Figure 7.

Figure 7: Roll-out of six sigma training

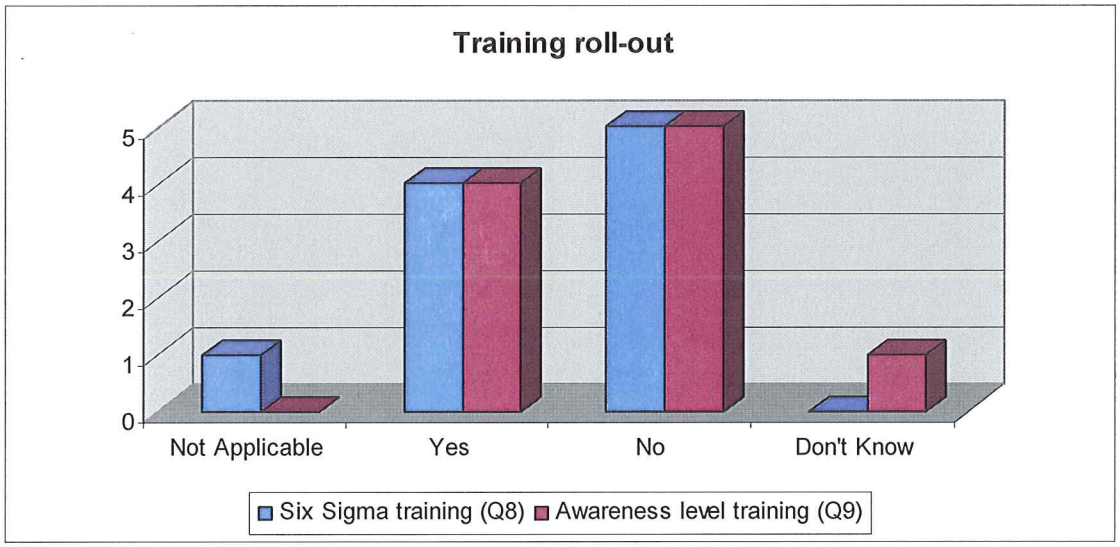
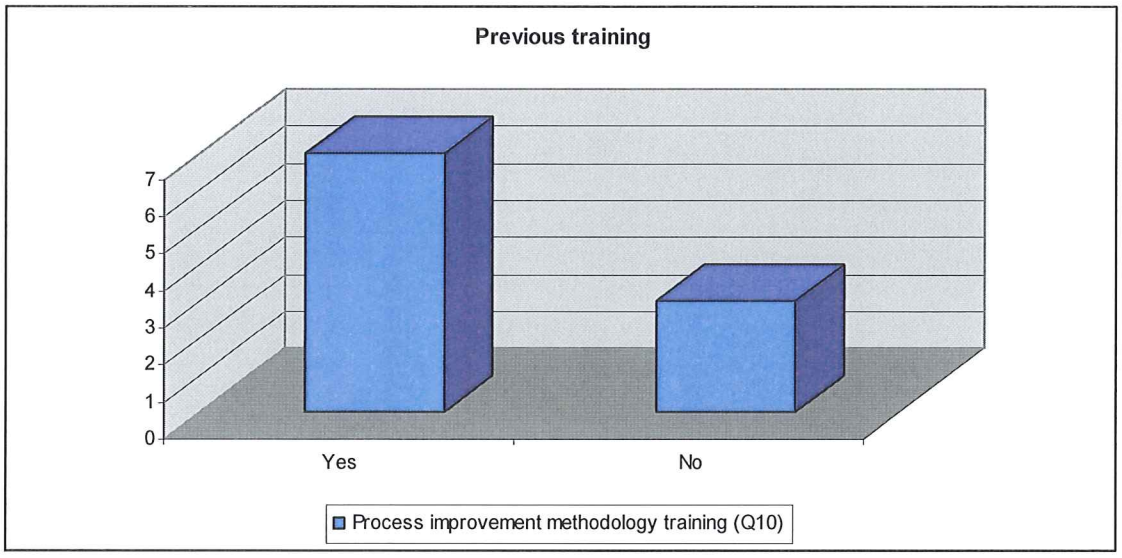


Figure 7 demonstrates that four of the respondents (40%) had colleagues who worked on their projects who were either trained in six sigma or had received six sigma awareness training. The respondents either answered yes or no to both questions with one exception as one respondent worked on their project alone and did not know if the awareness level training had been rolled-out in their area.

The next question was to establish if those answering the questionnaire had previously been trained in other process improvement methodologies such as Total Quality Management (TQM), Lean, Continuous Improvement, just-in-time, 5S or other similar methodologies. The detail of the responses are shown in Figure 8. For those that had received training in other methodologies the researcher is interested to establish if this training was with a previous company or with PCN.

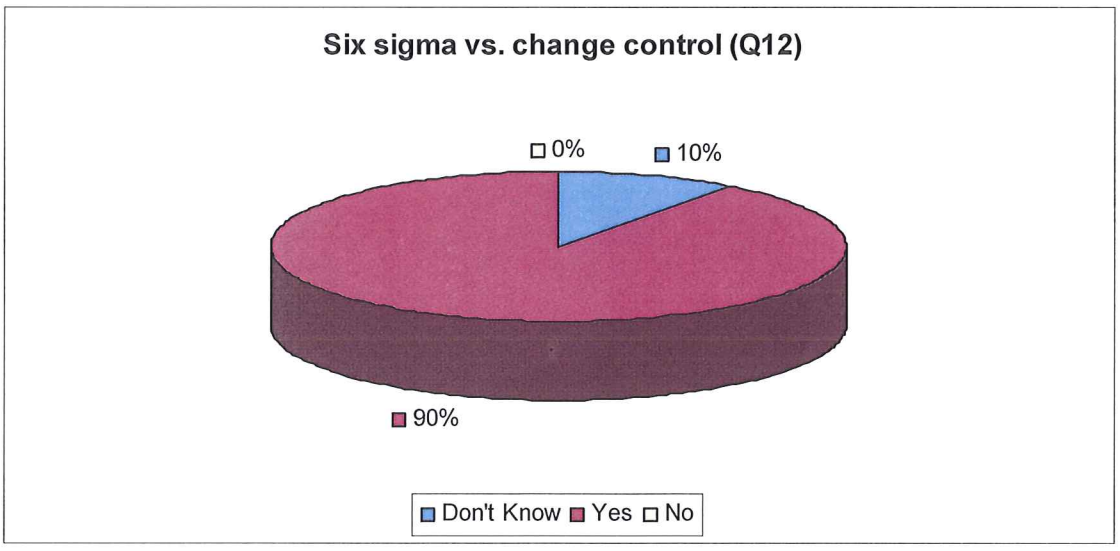
Figure 8: Previous training in process improvement methodologies



The findings, shown in Figure 8, reveal that 70% of the respondents had previously been trained in other process improvement methodologies. Of those who had previously been trained 30% had received training at PCN and 40% at a previous company.

The next question links the six sigma training with change management and whether this is perceived by the respondents as a separate initiative. The responses are shown in Figure 9.

Figure 9: Six sigma as a separate initiative to change control



The findings demonstrated in Figure 9 show that 90% of the respondents perceive the six sigma initiative as separate to the change control system. None of the respondents thought that six sigma was linked to the change control system utilised by the business.

Three questions were asked in order to understand the respondents perception of culture and change within the organisation as shown in Figure 10.

Figure 10: Perceptions of organisational culture

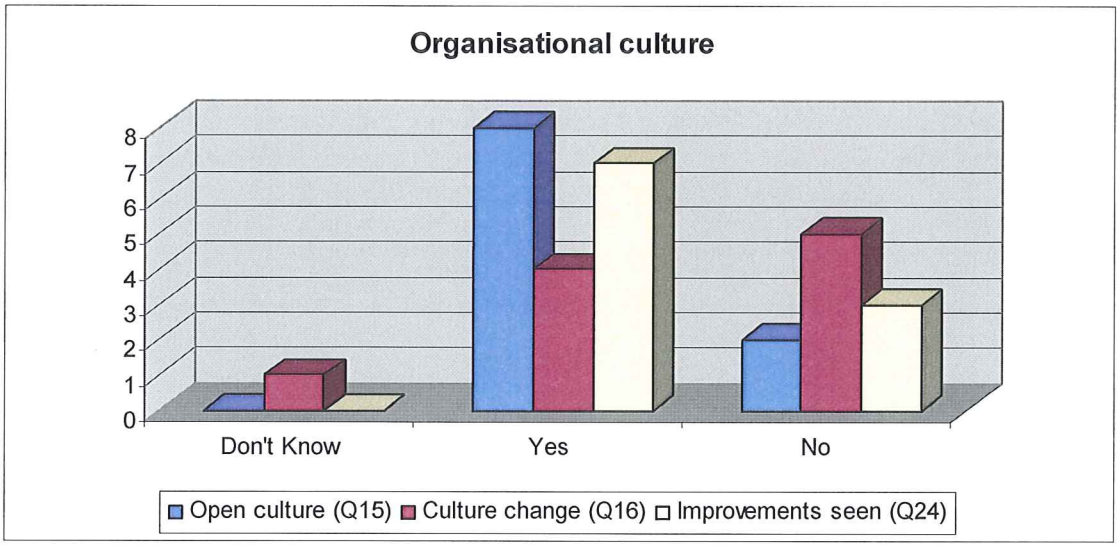
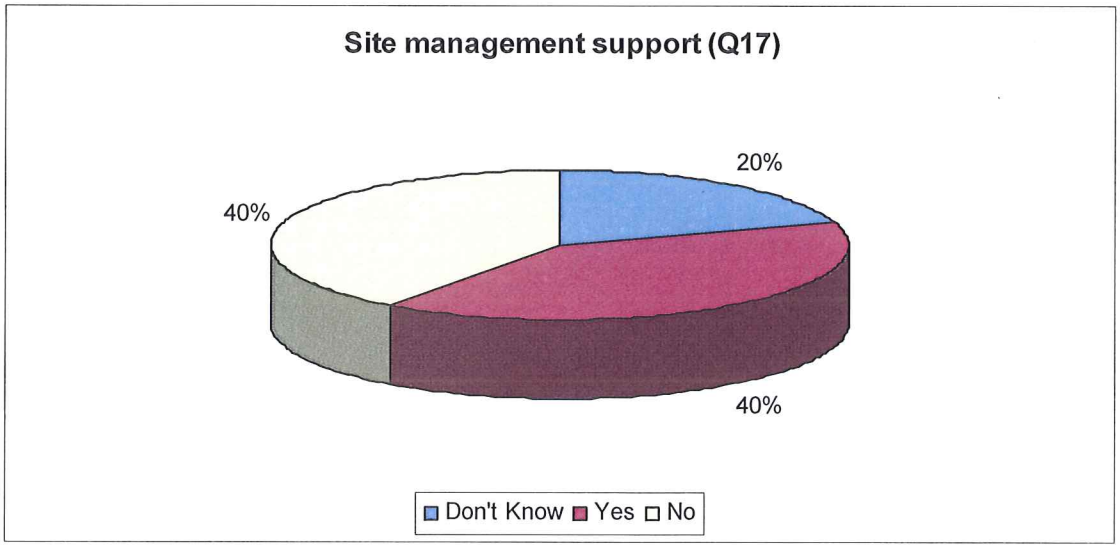


Figure 10 demonstrates that 80% of the respondents perceived the organisation to be open to six sigma and change. Only 40% of the respondents thought that the culture of the organisation had changed since the roll-out of the six sigma training although 70% had seen improvements within their area of the business since six sigma was introduced.

The respondents were asked if the six sigma program was visibly supported by the site management team in order to view their perceptions on leadership (refer to Figure 11).

Figure 11: Six sigma support by the site management team

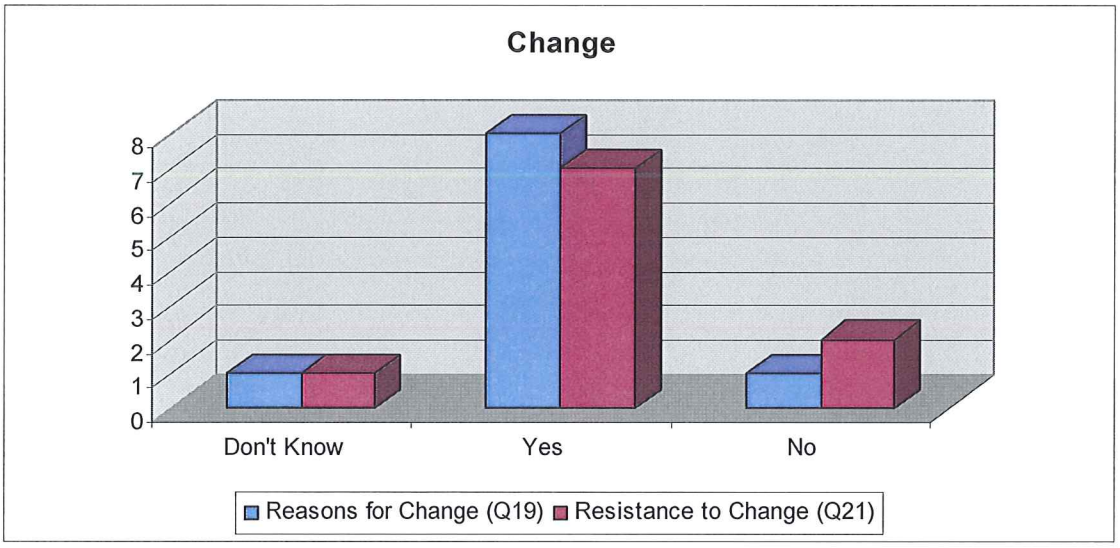


The results demonstrated in Figure 11 show that 60% of the respondents did not see that the six sigma program was visibly supported by the site management team.

The sample group were also asked if they were aware of the organisations strategic goals and objectives for 2010 which are cascaded down through the organisation from the site management team. 70% of the respondents stated that they were aware of the goals and objectives.

Questions 19 and 21 from the questionnaire asked the respondents if they were aware of any reasons for change within the business or if they were aware of any resistance to change as detailed within Figure 12.

Figure 12: Reasons for and resistance to change



The results revealed in Figure 12 show that 80% of the respondents were aware of reasons for change and 70% were aware of resistance to change within the business.

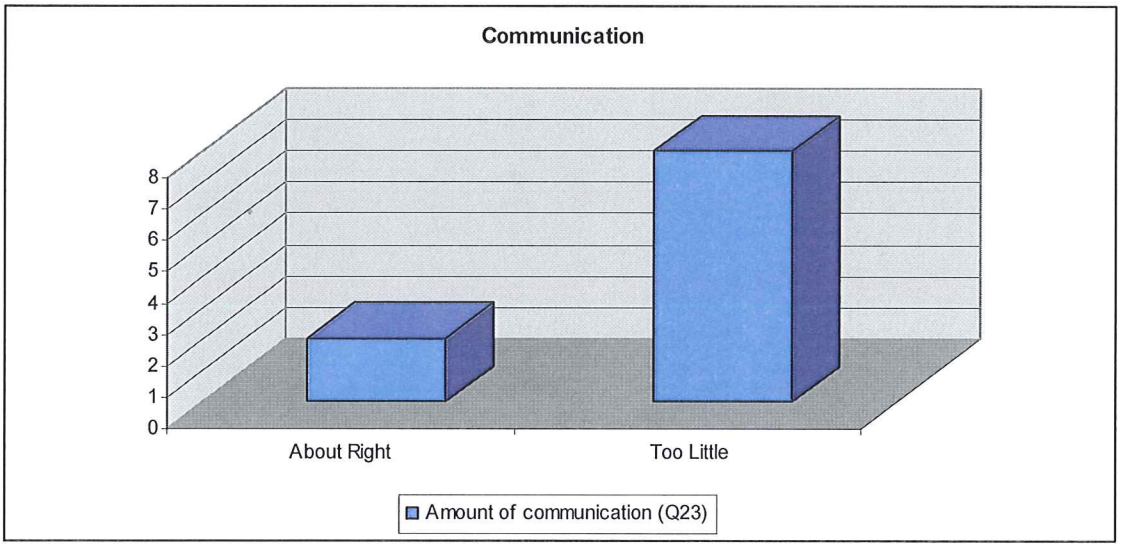
The respondents were also asked to identify any reasons for change or details any examples of resistance to change that they have seen within the business. All of the respondents were able to detail either a reason for change or an example of resistance to change. Their responses to these questions are listed in Table 1.

Table 1: List of reasons for change and resistance to change

Reasons for change (Q20)	Resistance to change (Q22)
Cost; Employee engagement; Changes to increase throughput; Profitability; Growth; New products; Process & system efficiency; To deliver, grow, maximise, improve and develop; Communication between levels and department can still be poor; We have to make quality products compliantly faster and cheaper; Need to reduce the cost of the product to remain competitive; To be the market leader with the lowest cost of goods.	People see improvements as a euphemism for losing pay; Change to shift patterns; Changes related to technical transfer of product; Cost; Resource; Time-scale of change; Limitations regarding global systems & changing their functionality; De-motivating instead of inspiring individuals to introduce change that will improve productivity without the intention of cost savings; Fear of the unknown; I just get objections or ignored.

The questionnaire then asked the respondents to rate the amount of communication they saw about the six sigma program and the communication on the outcome of any of the projects as detailed within Figure 13.

Figure 13: Six sigma communication



The chart, as seen in Figure 13, reveals that 80% of the respondents thought that they had seen too little communication about the six sigma program and projects with only 20% thinking that the levels of communication were 'about right'.

The questionnaire concluded with four demographic questions about the respondents. All of the respondents answered these question and the responses are detailed below.

The respondents comprised of a 50/50 split between male and female colleagues who answered the questionnaire.

Figure 14: Age of respondents

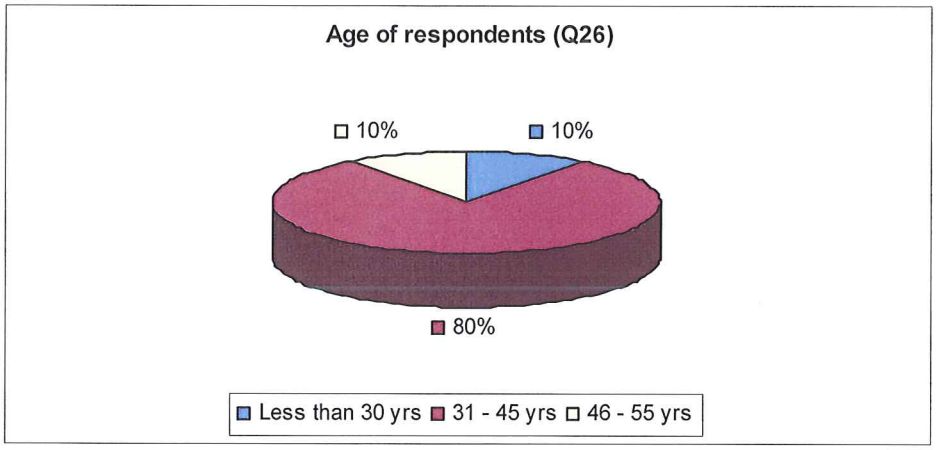


Figure 14 illustrates that the majority of the respondents to the questionnaire were aged between 31 and 45 years of age.

Figure 15: Length of service

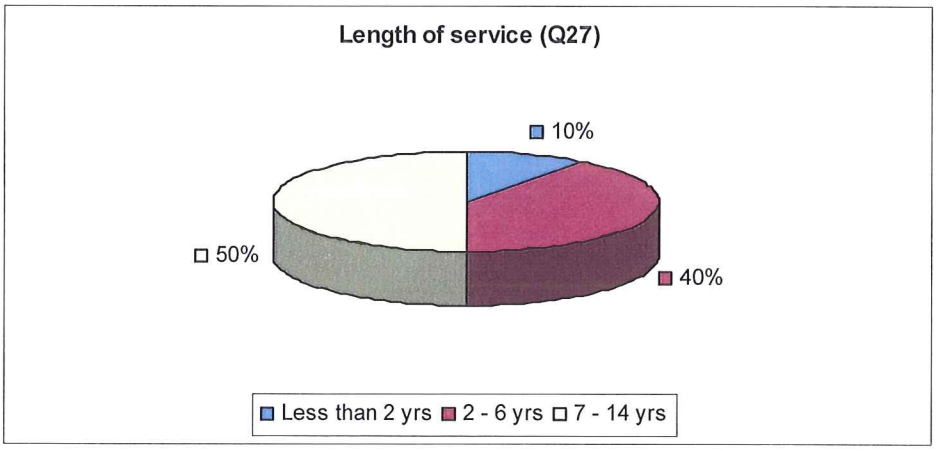


Figure 15 shows that 100% of the respondents had worked at the organisation for less than 15 years, with only 10% having worked in the organisation for less than two years.

Figure 16: Area of work

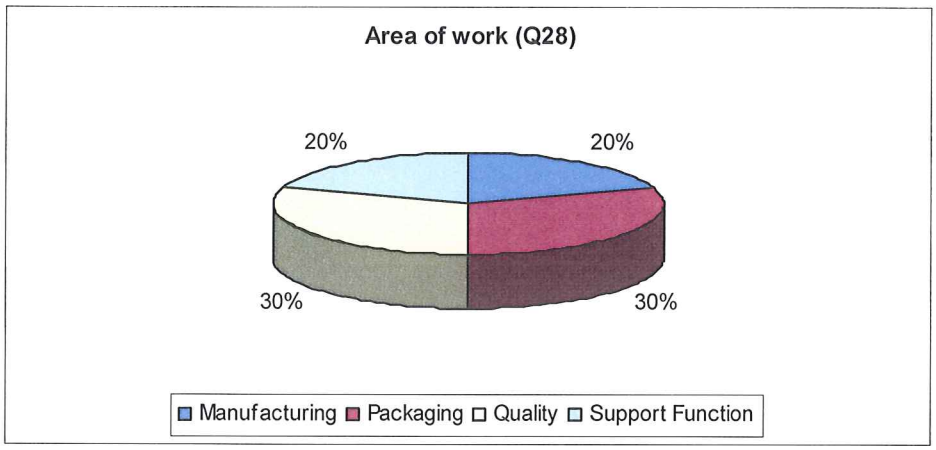


Figure 16 demonstrates that the respondents work across all areas of the business with no one function responding significantly more than any other.

4.5 Summary

In this chapter the findings and the data collected from the questionnaire were presented utilising, where applicable, histograms and pie charts. The analysis of the data within the context of the literature, as detailed within Chapter 2, along with the key points from the semi-structured interviews will be explored further in Chapter 5.

5 Conclusions

5.1 Introduction

The fifth chapter will further explore the analysis of the data set out within Chapter 4 within the context of the literature review as detailed in Chapter 2. Chapter 5 will also capture the key points from the semi-structured interviews where applicable to the discussion. This chapter will critically evaluate the adopted methodology for the research prior to addressing the research question and research aims along with any conclusions that can be drawn from the research. The chapter assesses the limitations of the study and discussed the opportunities for further research.

5.2 Critical evaluation of adopted methodology

The adopted methodology for the research has been detailed within Chapter 3. The methodology chosen is to conduct semi-structured interviews utilising a draft version of the questionnaire in order to aid in the design of the final version. The final version of the questionnaire (Appendix 2) is then distributed to a sample group within the PCN organisation.

The group selected to participate in the semi-structured interviews have been chosen due to their global positions as master black belts in addition to being trainers of the six sigma program within PCN. The global situation added a delay into the research as due to the nature of their jobs the interviewees were not available at the same site as the researcher for a number of weeks after they had agreed to participate in the research. This delay could have been overcome by the researcher conducting telephone interviews rather than face to face interviews but the researcher thought it important to maintain personal contact with the individuals for the research. This personal contact provides the opportunity for the interviewees to receive personal assurance about the way in which their interview responses will be used (Saunders et al., 2009).

The questionnaire has been sent out to a sample group of sixteen people within PCN who have previously been trained in the six sigma program. This group were chosen as they have completed their green belt six sigma training at least six months prior to receiving the questionnaire. The researcher is conscious that this is a small sample

group when compared to the size of the organisation as there are approximately eight hundred people employed by PCN within the UK site. When the sample group size is compared with the number of people within the organisation who have completed the six sigma training program then this sample size is considered representative as at the time of the research commencing only two groups of personnel had completed their six sigma green belt training. The second group were not chosen to participate in the questionnaire as they had only recently completed their training and therefore would have had insufficient time to complete a six sigma project. The responses to the questionnaire represent the current state of affairs around the implementation of the six sigma process and therefore different responses may be obtained if the questionnaire is issued to both groups in six or twelve months time. Three of the twenty eight questions within the questionnaire did not provide any useful data towards the research. The researcher attributes this to the current state of the respondents six sigma projects and therefore if these same questions are asked of both groups in the future a different response could be expected.

The response rate for the questionnaire is 62.5%. The response rate is slightly lower than the researcher had aimed for as Fisher (2007) asserts that when a questionnaire is distributed to employees in an organisation then a return rate of 70% or more might be achievable as it might be easier to chase up the responses. The researcher was able to send out a reminder to those completing the questionnaire which did provide additional responses but due to the confidential nature of the questionnaire it is not possible to identify individuals. The response rate concurs with Saunders et al. (2009) who state the likely response rate is variable but 30% is reasonable for either postal or intranet based questionnaires and the research approach of distributing the questionnaires via the internal email system combines a mixture of these approaches. The researcher may have increased the response rate by contacting the individuals in advance of sending the questionnaire in order to further explain the nature of the research and reassure any concerns about how the research data will be utilised.

5.3 Conclusions of the research objectives

The objectives of the research from Chapter 1 are as follows:

- To understand contemporary thinking on six sigma.
- To understand contemporary thinking on change management.
- To investigate the current approach to six sigma at PCN.
- To investigate the current approach to change management at PCN.
- To compare and contrast the contemporary thinking with the current approaches at PCN.
- To draw conclusions and make recommendations for the implementation of the six sigma process as a facet of the PCN change management programme.

The findings for each of the research aims will be discussed and conclusions drawn as appropriate for each of the objectives.

5.3.1 To understand contemporary thinking on six sigma

In order to understand contemporary thinking on six sigma the researcher conducted a literature review as detailed within Chapter 2, specifically sections 2.2 and 2.3. As well as six sigma the literature review considers lean thinking, TQM and other process improvement methodologies along with consideration of any relationships between these approaches. The contemporary thinking related to process improvement tools and training is also reviewed to understand the key points on these subject areas. The researcher also reviewed contemporary thinking on the subjects of culture, leadership and infrastructure as they relate to six sigma, lean and TQM.

5.3.2 To understand contemporary thinking on change management

The literature review to understand contemporary thinking on change management is detailed with Chapter 2, section 2.4. The paradigms of change are considered during the review. The reasons for change, the links to strategy and the organisation, along with the influence of both the internal and external environments, are considered as well as the reasons for resistance to change. The management of the change process is discussed in conjunction with commitment to change, leadership, culture and communication of change.

5.3.3 To investigate the current approach to six sigma at PCN

The current approach to six sigma at PCN has been to roll out a six sigma training program to the global PCN organisation during the last eighteen months. The training program was initially rolled out at the black belt level to a small group of people at each of the manufacturing sites. This was closely followed by training to a green belt level and after the initial roll out of the training program a further group has also received green belt training. The methodology for the research is to issue a questionnaire to those trained at the green belt level after the first phase of the implementation in order to assess their perception of the six sigma program at PCN. The findings from the questionnaire are detailed within Chapter 4.

5.3.4 To investigate the current approach to change management at PCN

PCN Pharmaceuticals develops, manufactures and sells licensed pharmaceutical products. PCN utilises a change management process to control any changes within the organisation. One aspect of the change control process is to assess the implications of any change upon the details filed with the regulatory authorities in the country where the product is sold. In order to assess the current approach to change management at PCN along with six sigma as a facet of this process the questionnaire issued contained questions relating to change management. The results from the questionnaire are detailed within Chapter 4.

5.3.5 To compare and contrast the contemporary thinking with the current approaches at PCN

The contemporary thinking on both six sigma and change management, as detailed within Chapter 2, will now be compared with the findings from the questionnaire along with the key points from the semi-structured interviews in order to represent the current approaches to both six sigma and change management at PCN, as introduced within Chapter 4, sections 4.3 and 4.4.

The questionnaire asked the respondents how many six sigma projects they had completed within the last twelve months since their green belt level training program.

The findings (section 4.4; figure 3) revealed that 70% of the respondents had yet to complete a project with only one respondent having completed more than one. In order for the respondents to become qualified at the green belt level within PCN they need to complete a six sigma project and the findings reveal that, despite this qualification requirement, there has been a low number of people who have completed projects and become qualified. The qualification approach as argued by Bendell (2006) ensures that the transfer of method to first application is effectively implemented and the findings could therefore suggest that the six sigma program has not yet been effectively implemented.

Rather than the implementation process the low rate of project completion may instead be attributed to the time required for the change process to occur which is supported by Gilgeous (1997) and Kotter (1995) who assert that successful change processes move through a series of stages that usually require a considerable length of time as change occurs slowly. The factor of time to change is supported by the response to the next question (section 4.4) as 80% of the respondents were able to detail the six sigma tools they are using which suggests at least a partial implementation of the program. Interviewee #1 highlighted that during the last twelve months there has been an unexpected increase in product demand and that the bigger business need has taken priority over the implementation process which further supports the argument that the time to change for this first phase of the six sigma implementation has been slow.

This premise is further supported by the results from question 4 (section 4.4; figure 4) which demonstrate that respondents were aware of zero to five projects being completed across the PCN site during the last twelve months. Womack and Jones (2003) assert that the improvement team should be able to see things changing before their eyes and these findings would suggest that this has not happened. These results could also bring into question the communication around the progress of the six sigma program as interviewee #2 stated that they were not aware how many projects have been completed despite their full time role in the six sigma program. The communication levels are further challenged by question 23 (section 4.4; figure 13) where 80% of the respondents thought that they had seen too little communication about the six sigma program. The risk for PCN is the impact that these communication levels have on those that have been through the six sigma training as Kotter (1995) argues that without credible communication, and a lot of it, the hearts and minds of the troops are never captured.

When the six sigma program was initiated at PCN the intention was that those who were trained as a green belt would have 25% of their working time to dedicate to their six sigma projects. The findings (section 4.4; Figure 5) show that only 20% of the respondents spent greater than 16% of their time working on six sigma projects. The results do not reveal the reasons why the green belts did not spend as much time on their projects but one of the concerns that is raised by these results is that the respondents are not being given the time to work on their projects. This result along with the fact that most of the respondents have yet to complete a six sigma project is of concern for the overall process of change as Kotter (1995) asserts that without short-term wins, too many people give up or actively join the ranks of those people who have been resisting change. Therefore the risk to PCN is that those who have already been trained may now become resistors to change.

The respondents were questioned as to whether they had received support for their project from either the black belts or their management. 20% of the respondents had received support from both the six sigma network and their management whereas 30% of the respondents received only management support for their work with the remaining respondents receiving no support (section 4.4; figure 6). This mixture of support was highlighted by both interviewees who commented that the support infrastructure has not been put in place for the first phase of the implementation, although they were now actively working towards putting in the required infrastructure across the site. These results do not support the argument by Antony (2007) who asserts that a characteristic of six sigma is that it creates a powerful team infrastructure for implementation of projects. Likewise PCN's six sigma program will not be successful until, as asserted by Blokdijk (2008), PCN has the ability to build an effective infrastructure. Therefore PCN must create this team infrastructure within the organisation and from the interviews it is clear that there are now plans in place to build this team. PCN must bear in mind when the team is being built, as Dahlgaard and Dahlgaard-Park (2006) argue, that this infrastructure and culture must be in place from the top management level to middle management and to the shop floor level.

Questions 8 and 9 (section 4.4; figure 7) show that only 40% of the respondents colleagues had received six sigma training or had received awareness level training. This may not be an issue for PCN as Womack and Jones (2003) assert that the change

agent doesn't need detailed lean knowledge at the outset but instead a willingness to apply it, therefore the researcher would need to further assess if the current levels of training are adequate for those involved with supporting six sigma projects until the training program has been rolled out through the organisation. The company wide approach to training when introducing a process improvement methodology is supported by Dahlgaard and Dahlgaard-Park (2006) who note that this approach assures that all people understand the what, how and why both at the overall level, the group level and the individual level.

There is an argument that there is nothing fundamentally new in six sigma and that six sigma is comparable with other process improvement methodologies (section 2.2.2) and as a consequence of these arguments the researcher aimed to establish if those who had completed the green belt training had previously received training in other improvement methodologies. The results (section 4.4; figure 8) show that 70% of the respondents had received training in the past either at PCN or with their previous company. It could be questioned as to why these individuals were nominated for the six sigma training program if they had previously received process improvement training and this is supported by Carreira and Trudell (2006) who state that having a black [or green] belt is not absolutely necessary, but having someone with certain skills is and therefore the organisation needs to give greater consideration to the skill base of those that are nominated for the black or green belt training.

The questionnaire found that 90% of the respondents perceived six sigma to be a separate initiative to the change control system and that no respondents thought that the two were linked (section 4.4; figure 9). These results disagree with Cao et al. (2000) who argue that process change is central to the concept of TQM although this argument does support the fact that interviewee #2 has tried to instil during the training program that the two concepts are not distinct but the findings suggest that this has not been the perception of the questionnaire respondents.

The results from the questionnaire, as shown within section 4.4; figure 10, look at the respondents perceptions of the culture within PCN, whether it is open to six sigma and change and whether the culture has changed since the six sigma roll out. The fact that 80% of the respondents thought that the culture of the organisation is open to change supports the argument by Dahlgaard and Dahlgaard-Park (2006) that programs such as

six sigma are very dangerous to adopt without the right company culture. Only 40% of the respondents thought that the culture of PCN had changed since the six sigma implementation which could support Sousa-Poza et al. (2001) who assert that the implementation and the corporate culture changes are likely to occur simultaneously. This suggests that the culture will continue to change at PCN as the six sigma training program is rolled out further, especially as 70% of the respondents had already seen improvements within their area of the business. Those involved with six sigma and change at PCN must be cautious with respect to culture change as it is argued by Kotter (1995) that until changes sink deeply into a company's culture … new approaches are fragile and subject to regression.

The findings show that 60% of those questioned did not perceive the six sigma program to be supported by the site management team (section 4.4; figure 11). This is an area of concern for PCN as Kotter (1995) argues that major change is impossible unless the head of the organisation is an active supporter and Holt et al. (2003) argue that the perception of the behaviours of formal leaders in the organisation must be that they support the change.

The researcher found that the majority of the respondents are aware of both the reasons for change and resistance to change within PCN (section 4.4; figure 12 & table 1) and the responses concur with the findings from the literature review (section 2.4.2 & 2.4.3). 70% of the respondents were aware of the PCN strategic goals and objectives for 2010 and this is reflected in their responses to the reasons for change. The external triggers identified include the activities of competitors and new products (Kotter & Schlesinger, 2008; Huczynski & Buchanan, 2001; Gilgeous, 1997) and these reasons for change are supported by the findings. One of the drivers for change identified by both the questionnaire respondents and the interviewees was that of cost along with the competitive environment which PCN operates in. One of the reasons for resistance to change, as found by Kotter and Schlesinger (2008), is a misunderstanding of the change and its implications and the findings support this, specifically the interviewees who found that the managers of those working on change projects misunderstood the time and resources that are needed to complete the six sigma projects.

5.3.6 To draw conclusions and make recommendations for the implementation of the six sigma process as a facet of the PCN change management programme

The research has utilised interviews and a questionnaire in order to assess six sigma as a facet of the change management process within PCN. The research findings relate to the study of the PCN organisation at one particular point in time and therefore the findings may not be able to be generalised across the entire organisation.

The findings from the research suggest that the implementation of the six sigma program has had mixed results so far for the group that responded to the questionnaire. The findings show that from the sample group of those trained to six sigma green belt level that 70% of the respondents had yet to complete a six sigma project during the twelve month period since they received their training, although some of the respondents stated in comments to the researcher that their projects had started but they had been unable to complete them. Despite some respondents having not completed a six sigma project 80% of the respondents were utilising the tools from their training either for an ongoing project or as part of their day to day job, therefore they are implementing at least some aspects of the training received although caution is needed as Bendell (2006) argues that the use of techniques alone does not in itself constitute being a lean organisation. One respondent observed that the implementation process has been affected by unexpected increases in product demand during that last twelve months and therefore the researcher notes that PCN needs to understand if this is the reason why the respondents have yet to complete their six sigma projects or if in fact the respondents are resisting change or, as noted by Kegan and Lahey (2001), they have a kind of personal immunity to change.

The research findings show that communication of the six sigma program within PCN is an area of concern as 80% of the respondents thought that there was too little communication about the program and this is also reflected in their lack of awareness around the number of projects successfully completed by other six sigma trainees. In addition 60% of the respondents did not perceive the six sigma program to be supported by the site management team. This should be a concern for PCN as if the change agents have not seen enough communication regarding six sigma or enough support from the leaders in the organisation then it could be also assumed that the rest of the organisation has seen too little communication. Therefore the researcher recommends that PCN

should increase the communication levels around the six sigma program and projects and that this communication must come from all levels within the organisation, especially from the PCN site management team, as Kotter (1995) asserts that major change is impossible unless the head of the organisation is an active supporter and therefore committed to the change process.

The research assessed the current infrastructure within PCN and how this relates to six sigma as a facet of change management. From the research findings it is clear that the respondents in the sample group did not spend as much time working on their projects as was originally intended by the organisation at the outset of the six sigma program. The research also found that at least 70% of the respondents did not receive support to complete their six sigma project from either the network of six sigma black belts or from their departmental management team. Both of the interviewees commented that the support infrastructure is not currently in place for those completing six sigma projects but there are plans to put the required infrastructure into place. Blokdijk (2008) asserts that the essential tool to six sigma success is the ability to build an effective infrastructure, therefore the researcher supports the plans by the organisation to establish an infrastructure to support the six sigma program as further training is rolled out at PCN.

The research found that 90% of the respondents perceived six sigma to be a separate initiative to the change control system that is in place at PCN. The conceptual model (figure 2) utilised for the research is based upon the process improvement methodologies, the tools and training, and the people as being central to the change management process and therefore the researcher found it of interest that the sample group did not perceive six sigma to be a part of the change management process. One respondent stated that the message they give during the training is that these two concepts are not distinct. Therefore the researcher recommends that this message needs to be reiterated throughout the training program to ensure it is understood especially as Cao et al. (2000) argue that process change is central to the concept of TQM. In addition this message needs to be reinforced whilst the trainees are working on the early stages of their six sigma projects.

The research found that 80% of the respondents thought that the PCN culture is open to change and 70% of the respondents have already seen improvements within their area of

the business. The research also found that 40% of the respondents have seen the culture change during the period that the six sigma program has been introduced. The researcher notes that caution is required and that it should not be assumed that the six sigma program alone has brought about this culture change as the researcher is aware that there is an initiative being rolled out in parallel to bring about a change in the behaviours and culture within PCN. Sousa-Poza et al. (2001) argue that it is unlikely that a company can change its culture merely by deciding to implement TQM, therefore the researcher supports PCN in the roll-out of both the six sigma and culture change initiatives to bring about change to the organisation.

The research found that all of the respondents are aware of the reasons that drive change within PCN and all respondents could identify reasons for resistance to change. Despite this there were still 30% of the respondents who were not aware of the PCN strategic goals and objectives for 2010 which highlight the areas which are a focus for change. The researcher therefore supports the PCN approach to clearly communicating the reasons that are driving change within the business, as well as the 2010 site objectives, as Burnes (2004) argues that members of the organisation must come to appreciate that change is not only inevitable but it is being taken to safeguard, rather than threaten, their future.

5.4 Overall conclusions

The conclusions to the research question six sigma as a facet of change management are detailed within section 5.3.6. The key points from these conclusions are summarised below:

- The six sigma implementation process has been affected by unexpected increases in product demand during that last twelve months. PCN must try to understand if this is the reason why the majority of respondents have yet to complete their six sigma projects or if in fact change is being resisted by the respondents.
- PCN should increase the communication levels around the six sigma program and projects and the communication must come from all levels within the organisation, especially from the PCN site management team as Dahlgaard and

Dahlgaard-Park (2006) argue that the essence of TQM, lean production and six sigma quality may be boiled down to leadership.

- The PCN organisation should establish an effective infrastructure, as asserted by Blokdijk (2008), to support the six sigma program as further training is rolled out.
- It is recommended that the message that change management is central to the six sigma process, as argued by Cao et al. (2000), should be reiterated throughout the training roll-out.
- PCN should continue to roll-out the six sigma initiative in parallel with the initiative to bring about a change in the behaviours and culture within PCN.
- PCN must continue to communicate the reasons that are driving change within the business as well as the site objectives and goals in order that members of the organisation can come to appreciate that change is not only inevitable but it is being taken to safeguard, rather than threaten, their future (Burnes, 2004).

5.5 Limitations of the study

The research into the question of six sigma as a facet of change management at PCN Pharmaceuticals was limited in a number of ways. The research methodology utilised a small sample group who are representative of those that have received the six sigma green belt training and therefore due to the size of the sample group the findings may not be able to be generalised as being representative of the perceptions of the whole organisation although due to the small sample group this transferability can only be answered by judgement and not by calculation (Fisher, 2007).

The research was designed to capture a certain point in the roll-out of the six sigma implementation process and therefore only represents the point in time at which the questionnaire was issued. A follow up study with the same respondents or a repeat of the questionnaire at a later point in time with an expanded sample group may produce different results. The study was limited to one manufacturing site of an organisation in the pharmaceutical industry and therefore the findings may not be generalised for other manufacturing sites within the same organisation, other organisations or other industries.

5.6 Opportunities for further research

Following the completion of this research there are a number of opportunities for further research. The same questionnaire could be utilised to survey the perceptions of all employees at the PCN site in order to assess the perceptions of the site as a whole. The research could incorporate the perceptions of the six sigma roll-out at multiple sites in multiple countries within the organisation. The culture of the different sites and countries and its influence on the six sigma program could also be researched. A longitudinal study rather than a cross sectional study could be undertaken as Saunders et al. (2009) assert that this type of research has the capacity to study change and development and could therefore assess any changes to the organisation during the roll-out of the six sigma program. Another opportunity for further research would be to compare six sigma as a facet of change management throughout organisations within the pharmaceutical industry or other industries.

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List of Appendices:

Appendix 1: Questions and Theoretical Links

Number	Question	Link to Theory
1	How many six sigma projects have you completed within the last 12 months ?	This question links to the first implementation of the training (Bendell, 2006), visibility of changes (Womack & Jones, 2003; Kotter, 1995) and the time needed for change (Gilgeous, 1997; Kotter, 1995).
2	Please detail which six sigma tools you have used in your project or you have used as part of your day to day job ?	This links to the theory on tools and training (Antony, 2007; Bendell, 2006; Carreira & Trudell, 2006) and the conceptual model detailed within Section 2.5.
3	Did the completed project meet the outcomes or targets as planned ?	This question links visibility of changes (Womack & Jones, 2003; Kotter, 1995) along with the catalysts for change (Burnes, 2004; Beer et al., 1990).
4	How many other six sigma projects are you aware of being successfully completed by six sigma leaders across the site within the last 12 months ?	This relates to visibility of change (Womack & Jones, 2003, Kotter, 1995) along with communication of the change process (Burnes, 2004; Stone, 1996; Kotter, 1995; Beer et al., 1990).
5	25% of the working time for six sigma green belts has been allowed for six sigma projects, how much of your working time were you given to work on these projects over the last twelve months ?	This question links into the time required for change and the management of the change process (Gilgeous, 1997; Kotter, 1995).
6	Were you supported by either your department black belt or a global master black belt to complete your six sigma project ?	This question links to culture, infrastructure and leadership (Blokdijk, 2008; Dahlgaard & Dahlgaard-Park, 2006; Womack & Jones, 2003; Holt et al., 2003; Sousa-Poza et al., 2001; Senge 1999; Irani et al., 1997; Gilgeous, 1997; Stone, 1996; Kotter, 1995; Beer et al., 1990).
7	Were you supported by either your team manager or department manager to complete your six sigma project ?	This question continues on utilising the theory from question 6.

8	Did the associates working with you on your six sigma project receive six sigma training ?	Question 8 links to the people within the team (Blokdijk, 2008; Antony, 2007; Buch & Tolentino, 2006; Dahlgaard & Dahlgaard-Park, 2006; Womack & Jones, 2003; Knippen & Green, 1997; Irani et al., 1997; Stone, 1996) as well as training from the conceptual model.
9	Has six sigma awareness training been rolled out in your area ?	This is a continuation of the theory detailed within question 8.
10	Have you previously been trained in other process improvement methodologies such as Total Quality Management (TQM), Lean, Continuous Improvement, just-in-time, 5S or other similar methodologies ?	This question links to an individuals skills that they may already have (Carreira & Trudell, 2006). This also links into whether six sigma is seen as new or different (Blokdijk, 2008; Kumar et al., 2008; Bendell, 2006; Dahlgaard & Dahlgaard-Park, 2006; Womack & Jones, 2003; Klefsjö et al., 2001; Gore, 1999).
11	If you have previously been trained in other process improvement methodologies where did you receive this training ?	This is a continuation of the theory from question 10.
12	Do you think six sigma projects are seen as separate initiatives to the change control system on site ?	This links to process change (Cao et al., 2000; Irani et al., 1997).
13	Has your six sigma project required a change control to be completed ?	This is a continuation of the theory from question 12.
14	Has your six sigma project had a regulatory impact ?	This question links to the environment from the conceptual model along with the theory on reasons for change.
15	Do you think the culture of the organisation open to six sigma and change ?	This question links to the theory on culture and change (Dahlgaard & Dahlgaard-Park, 2006; Burnes, 2004; Sousa-Poza et al., 2001; Helms & Stern, 2001; Sadri & Lees, 2001; Cao et al., 2000; Gore, 1999; Irani et al., 1997; Gilgeous, 1997; Stone, 1996; Kotter, 1995; Brooks, 1994).
16	Has the culture of the organisation changed since the roll out of the six sigma training ?	The question is a continuation of the theory from question 15.

17	Is the six sigma program visibly supported by the site management team ?	This links to the theories on commitment as well support from leaders (Burnes, 2004; Senge 1999; Kotter, 1995; Beer et al., 1990).
18	Are you aware of the organisations strategic goals and objectives for 2010 ?	This question links to the strategy for change (Kotter & Schlesinger, 2008; Porter, 2008; Burnes, 2004; Cicmil, 1999; Feurer & Chaharbaghi, 1997; Beer & Eisenstat, 1996; Mintzberg, 1987) along with the environment from the conceptual model.
19	Are you aware of any reasons for change within the business ?	This question directly relates to the theories around reasons for change (Kotter & Schlesinger, 2008; Kumar et al., 2008; Hartley, 2002; Huczynski & Buchanan, 2001; Gilgeous, 1997; Kotter, 1995; Beer et al., 1990).
20	Please identify any reasons for change seen within the organisation ?	The question is an open question that expands on the theory from question 19.
21	Are you aware of any resistance to change within the business ?	This question directly relates to the theories around resistance to change (Kotter & Schlesinger, 2008; Leahy & Chamberlain, 2008; Burnes, 2004; Holt et al., 2003; Kegan & Lahey, 2001; Ansoff, 1998; Gilgeous, 1997; Kotter, 1995; Strebel, 1996; Beer et al., 1990).
22	Please detail any examples of resistance to change seen within the organisation ?	The question is an open question that expands on the theory from question 21.
23	How do you rate the amount of communication about the six sigma program and the project outcomes ?	This question links directly to communication of change (Burnes, 2004; Stone, 1996; Kotter, 1995; Beer et al., 1990).
24	Have you seen improvements within your area of the business since the introduction of six sigma ?	This question also links into the theory on communication (Burnes, 2004; Stone, 1996; Kotter, 1995; Beer et al., 1990).
25	Are you Male or Female ?	This question relate to employee perceptions of culture (Helms & Stern, 2001).

26	How old are you ?	This demographic question also relates to employee perceptions of culture (Helms & Stern, 2001; Siegal et al.,1996).
27	How long have you worked at PCN Pharmaceuticals ?	Question 27 also links to the theory detailed within questions 25 and 26.
28	Please state which area you work in ?	This question is designed to identify if the respondent works in a manufacturing or non-manufacturing area (Kumar et al., 2008; Dahlgaard & Dahlgaard-Park, 2006).

Appendix 2: Six Sigma Green Belt Questionnaire

Thank you for taking the time to respond to this questionnaire. The purpose of this questionnaire is to collect information for a research dissertation. All responses will remain confidential throughout the research.

If you wish to complete the questionnaire electronically, double click on the box next to your response, select 'checked' and click 'OK'. You will now have an X in the box. Please also type in any detailed responses where applicable. Alternatively, please print and scan / post the completed questionnaire.

Please return all completed questionnaires by email or in the internal mail system to Clare Hughes by 07th April.
Please call me directly if you have any queries surrounding this questionnaire.

1. How many six sigma projects have you completed within the last 12 months ?

   None ☐ One ☐ Two ☐ Three or more ☐

2. Please detail which six sigma tools you have used in your project or you have used as part of your day to day job ?

.....
.....

3. Did the completed project meet the outcomes or targets as planned ?

   Not Applicable ☐ Yes ☐ No ☐

4. How many other six sigma projects are you aware of being successfully completed by six sigma leaders across the site within the last 12 months ?

   None ☐ 1-5 ☐ 6-14 ☐ 15 or more ☐

5. 25% of the working time for six sigma green belts has been allowed for six sigma projects, how much of your working time were you given to work on these projects over the last twelve months ?

   None ☐ 1-15% ☐ 16-25% ☐ 26% or more ☐

6. Were you supported by either your department black belt or a global master black belt to complete your six sigma project ?

   Not Applicable ☐ Yes ☐ No ☐

7. Were you supported by either your team manager or department manager to complete your six sigma project ?

   Not Applicable ☐ Yes ☐ No ☐

8. Did the associates working with you on your six sigma project receive six sigma training ?

Not Applicable ☐ Yes ☐ No ☐ Don't Know ☐

9. Has six sigma awareness training been rolled out in your area ?

Not Applicable ☐ Yes ☐ No ☐ Don't Know ☐

10. Have you previously been trained in other process improvement methodologies such as Total Quality Management (TQM), Lean, Continuous Improvement, just-in-time, 5S or other similar methodologies ?

Don't Know ☐ Yes ☐ No ☐

11. If you have previously been trained in other process improvement methodologies where did you receive this training ?

Not Applicable ☐ PCN Pharmaceuticals ☐ Previous Company ☐

12. Do you think six sigma projects are seen as separate initiatives to the change control system on site ?

Don't Know ☐ Yes ☐ No ☐

13. Has your six sigma project required a change control to be completed ?

Not Applicable ☐ Yes ☐ No ☐ Don't Know ☐

14. Has your six sigma project had a regulatory impact ?

Not Applicable ☐ Yes ☐ No ☐ Don't Know ☐

15. Do you think the culture of the organisation is open to six sigma and change ?

Don't Know ☐ Yes ☐ No ☐

16. Has the culture of the organisation changed since the roll out of the six sigma training ?

Don't Know ☐ Yes ☐ No ☐

17. Is the six sigma program visibly supported by the site management team ?

Don't Know ☐ Yes ☐ No ☐

18. Are you aware of the organisations strategic goals and objectives for 2010 ?

Don't Know ☐ Yes ☐ No ☐

19. Are you aware of any reasons for change within the business ?

Don't Know ☐ Yes ☐ No ☐

20. Please identify any reasons for change seen within the organisation ?

.....
.....

21. Are you aware of any resistance to change within the business ?

Don't Know ☐ Yes ☐ No ☐

22. Please detail any examples of resistance to change seen within the organisation ?

.....
.....

23. How do you rate the amount of communication about the six sigma program and the project outcomes ?

Too Much ☐ About Right ☐ Too Little ☐ Don't Know ☐

24. Have you seen improvements within your area of the business since the introduction of six sigma ?

Don't Know ☐ Yes ☐ No ☐

25. Are you: Male ☐ Female ☐ ?

26. How old are you ?

Less than 30 yrs ☐ 31-45 yrs ☐ 46-55 yrs ☐ 56 yrs or over ☐

27. How long have you worked at PCN Pharmaceuticals ?

Less than 2 yrs ☐ 2-6 yrs ☐ 7-14 yrs ☐ 15 yrs or over ☐

28. In which area do you work ?

Manufacturing ☐ Packaging ☐ Quality ☐ Support Function ☐

Please provide any additional comments or feedback you feel is appropriate.

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.....
.....

Thank you for taking the time to complete this questionnaire.

Please return all completed questionnaires to Clare Hughes by 07th April 2010.